



SECTION THREE

GUIDE FOR THE FUTURE

A. Strategies

According to the California Environmental Dialogue, habitat protection, restoration, and enhancement leads to economic benefits relative to natural systems, recreational and leisure industry, and reduction of conflict caused by species extinction, among other concerns. In particular, “the protection, enhancement, and restoration of California watersheds, riparian stream zones, and wetlands will reduce the need for costly new water treatment plants, provide high quality drinking water at reduced cost, reduce costs of flood damage, and improve water quality for aquatic ecosystems and human recreation.” When considering why the Santa Ana Watershed community is interested in pursuing strategies, recommendations, and projects/opportunities identified in this document, one can reflect upon the fundamental nature of the rich ecological resources within the Watershed as well as the community’s interest in protecting these resources for present and future generations.

1. Creation, Restoration, and Enhancement of Wetlands

This strategy serves to further the overall principle of improving water quality and preserving and improving ecosystem function. Specific ways to improve water quality and preserve and improve ecosystem function are as follows:

- 1-A. Develop water treatment wetlands and channels to improve water quality in a sustainable manner and provide multiple benefits.
- 1-B. Protect, restore and widen riparian vegetation corridors to improve water quality, reduce impacts of stormwater runoff, provide habitat, and improve aesthetics.
 - Reintroduce vegetated buffer strips wherever possible along stream banks to reduce the force of a flooding current against the bank, slow water overflowing channel banks, and allow sediment to deposit.
 - Ensure that riparian vegetated buffer strips are as wide as possible, although a narrow strip is better than none at all.
- 1-C. Carefully plan human activities to reduce erosion.
- 1-D. Continue to utilize technologically advanced sustainable solutions to resource management dilemmas, such as water quality improvements.
- 1-E. Reduce or eliminate beach closures through water quality improvements and reduction of contaminant discharge into the Pacific Ocean.

History and Regulation of Wetlands

Within the State of California, estimates of historic wetland acreage range from 3 to 5 million acres; estimates of current acreage hover around 450,000 acres. Worldwide, a familiar pattern has emerged: destruction of wetlands in conjunction



with increasing urbanization has resulted in numerous water quality problems. California has had an 85 to 90 percent reduction in wetland acreage and leads the United States in wetland loss, tying only with Ohio. As a nation, the United States has experienced one of the world's worst wetland losses. Within the Santa Ana Watershed, little information is available on historic wetlands, and loss estimates are uncertain. However, watershed planners within the Santa Ana Basin are working towards restoring natural wetlands and providing treatment wetlands to provide cleaner water while providing high value habitat, recreation, and educational opportunities.

Historically, wetland ecology has not been well understood and humans did not grasp the importance of wetlands to improving water quality, maintaining healthy fisheries, and preserving populations of native flora and fauna. Considered unclean, wetlands were viewed solely as a breeding ground for mosquitoes and other vectors. Landowners wishing to develop their properties were permitted by law to fill in the wetlands and build homes or commercial development. In fact, federal laws such as the Swamp Lands Acts of the 1800s encouraged infill of wetlands by giving 65 million acres to 15 states (including California) for reclamation. Not until the Federal Clean Water Act was enacted in 1972 was there a piece of major legislation restricting the filling of wetlands. Section 404 of the Clean Water Act authorized the U.S. Army Corps of Engineers to issue permits for the discharge of dredged or fill material into waters of the United States, including wetlands. This section of the Clean Water Act has been interpreted to give the U.S. Army Corps of Engineers jurisdiction over permitting wetlands fill.

California wetlands policy is more restrictive than the federal wetland policy. The goal of California Wetlands Conservation Policy (1993) is to ensure no net loss of wetlands within the state. This policy, incorporated in an executive order by Governor Pete Wilson, also encourages a long-term net gain in the state's quantity, quality, and permanence of wetlands acreage and values. Interpretation of this order indicates that any developer wishing to fill in wetlands for construction of new development must perform mitigation in the form of constructed wetlands elsewhere at ratios ranging from 2:1 to 10:1. In addition to the U.S. Army Corps of Engineers, State regulatory agencies claiming jurisdiction over wetlands include the California Department of Fish and Game and the State Water Resources Control Board. Additionally, the U.S. Fish and Wildlife Service becomes involved when endangered species issues arise, as happens often in wetland areas. These regulatory agencies, while eager to work with landowners and developers, are directed to preserve natural wetlands over the creation of new wetlands through off-site mitigation. These policies have made it more difficult for developers to fill in natural wetlands by exercising discretionary disapproval of permits for wetland activities.



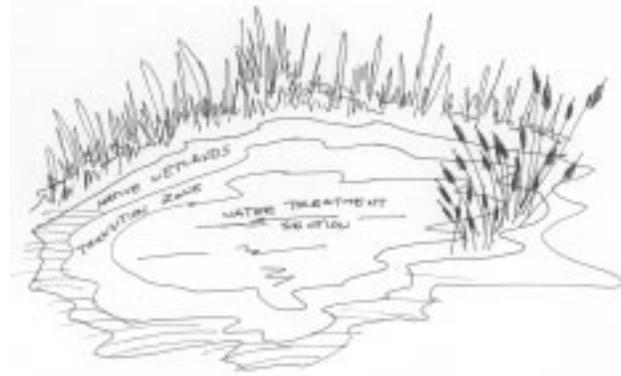
Wetlands, such as the one shown here in Upper Newport Bay Regional Park, improve water quality by filtering contaminants.

Photo courtesy of EIP Associates



Wetland Types

When discussing wetlands projects, it is useful to define three types of wetlands, differentiated by how they were formed: natural wetlands, constructed (treatment) wetlands, and created wetlands. Natural wetlands are those formed by natural ecological processes independent of human intervention. Natural wetlands include swamps, marshes, and estuaries, such as those found at the mouths of rivers where both fresh water and saltwater meet or those found inland in areas of high groundwater. Today, natural wetlands are still threatened by development, although many developers are realizing that the cost of mitigating for lost wetlands is often higher



This sketch illustrates a combined native and treatment wetland, with treatment wetland at the center surrounded by native wetland and separated by a transition zone.

than altering site designs to avoid building on wetlands (including a wetlands buffer zone). Constructed wetlands are those designed, built, and managed to provide specific water treatment capabilities. Wetlands in the Santa Ana Region are most often constructed to remove nitrogen and to treat stormwater. Many dairies are experimenting with constructed wetlands to treat washwater and other wastewater on site, such as OCWD's Fairview Farms dairy washwater treatment demonstration project in the Chino Basin. In addition, wetlands are constructed to polish water from publicly owned treatment

works (POTWs). Created wetlands are those wetlands that are created incidentally to another project. The most common example of created wetlands is that created by a newly constructed dam.

Biology of Treatment Wetlands: How Do They Work?

Using treatment wetlands as an adjunct to wastewater treatment plants provides multiple benefits to an area. Treatment wetlands provide habitat to a multitude of species, such as birds, mammals, reptiles, amphibians, and fish. Wetlands are much more aesthetically pleasing to the public than wastewater treatment plants. When planned in conjunction with regional trails, wetlands also provide recreational benefits.

Wetlands have been shown to be effective at removing sediment, harmful bacteria, phosphorus, and nitrogen from runoff water. Additionally, advanced wetlands can reduce endocrine disruptors and other compounds that remain after treatment in common POTWs. Within Santa Ana River Watershed, nitrogen is a major contaminant of concern. In the case of nitrogen removal, denitrifying microorganisms present in the wetland substrate (denitrifiers) serve to remove nitrogen from nutrient-rich water. Wetland plants take in nitrogen rich water, transferring nitrogen to the soil through the photosynthetic process. The denitrifiers in the soil process the nitrogen and ultimately release it back into the atmosphere as gas. This release of nitrogen gas is not harmful to the environment, as earth's atmosphere is 71 percent nitrogen. Wetland plants also increase the efficiency of the denitrification process by providing a significant source of needed carbon to the denitrifiers. Wetland scientists have refined the construction of wetlands to maximize pollutant removal.



Siting of Treatment Wetlands

The Regional Water Quality Control Board cautions against converting existing healthy riparian habitat to treatment wetlands, citing abundant evidence that riparian habitat can be very effective in removing contaminants from stormwater. Riparian habitat is no less valuable than wetland habitat, and is as much at risk. In addition, many threatened and endangered species depend on riparian habitat in Southern California. The replacement of functioning riparian habitat with constructed wetlands on a site that has not historically supported wetlands does not improve overall ecosystem function. Healthy riparian habitat should be conserved in balance with wetland creation. In addition, placement of treatment wetlands must take into consideration seasonal variability and downstream water supply issues to ensure consistent water supply for downstream users. It should be noted that when wetlands are located inland, the primary function is to reclaim or polish treated wastewater. For 340 to 350 days of the year, water flowing from proposed areas for wetland treatment would not reach the ocean in this region.

Economic and Other Benefits Provided by Wetlands

Nationwide, over 75 percent of commercially harvested fish are dependent on wetlands during at least one part of their life cycle. If shellfish are included, this percentage increases to 95 percent. Within Southern California, coastal wetlands serve as nurseries for commercially important fish and shellfish species, including anchovy, bass, and California halibut. Wetland-dependant fish species caught by recreational fishers include cabezon, rockfish, and sculpin. Juvenile fish will use the shallow waters of a wetland as a refuge from larger fish that cannot enter such shallow

areas. In addition, wetland areas provide economically important tourist destinations for those travelers wishing to bird-watch or enjoy nature. Wetlands are desirable areas for birdwatchers, as wetlands provide important stopovers for migrating birds along the Pacific Flyway. As tourism is a cornerstone of Southern California's economy, ensuring diverse opportunities for visitors is vital to ensuring sustainability of the region's tourism industry.

Notable Wetlands Projects within the Santa Ana Watershed

Although the Santa Ana Watershed is home to numerous effective wetland projects, this section will focus on a few illustrative examples of wetlands projects. These projects were chosen as representative examples of the different types of wetland projects within the Watershed to highlight the innovative ways in which agencies and organizations are implementing wetland projects to achieve multiple benefits. For more information on wetland projects, please consult Table 3-9, which includes a much more complete list of wetland projects within the Watershed by geographic area.

Prado Wetlands

Within Orange County Water District's 2,150-acre land holdings behind Prado Dam lies one of the world's largest constructed wetlands. Operating since 1992 and totaling 465 acres, the system consists of fifty shallow ponds used for water quality improvements. The primary purpose of the wetlands is to remove nitrogen from the River. Above Prado Dam, 50 percent of the base flow water is diverted into the wetlands. The wetlands system reduces nitrate concentrations from 10 milligrams per liter (borderline for drinking water quality) to less



Prado Wetlands
Photo courtesy of SAWPA

than one milligram per liter during summer months. It is the Orange County Water District's goal to treat 100% of Santa Ana River flows.

The Prado Wetlands have been hailed as a success from a habitat conservation standpoint. Within the wetlands, federally endangered least Bell's vireo populations have increased dramatically and are used as a much publicized success story of endangered species recovery. Within the Prado Basin, the population rose from 19 pairs in 1986 to 123 pairs in 1993. By the end of 1996, the count stood at 195 nesting pairs and this number rose to 224 by 1999. This stunning recovery is due to the provision of high-quality habitat for the bird species, a project in place to control populations of the predatory cowbird, and other restoration efforts on the part of agencies such as the U.S. Fish and Wildlife Service and Orange County Water District, including the removal of invasive plant species.

In 1997, the wetlands were reconstructed to increase the capacity of the wetlands to handle the increased base flow that is expected with population increases. Since the River is dominated by effluent and urban runoff, population increases raise the amount of effluent produced and therefore increase river flows. Future plans for the wetlands may include expansion of constructed wetlands and the City of Ontario's implementation of a Wildlife and Raptor Conservation Area adjacent to the Prado Wetlands.

Hemet/San Jacinto Multi-purpose Constructed Wetlands

The Hemet/San Jacinto Multipurpose Constructed Wetlands, a cooperative effort between the Eastern Municipal Water District and the Bureau of Reclamation, diverts over one million gallon daily from the Hemet/San Jacinto Regional Water Reclamation Facility. The constructed wetlands are approximately 50 acres in size and support a multitude of activities including recreation, bird watching, and research. The project was constructed in stages: first, the Wetlands Research Facility consisting



Riverside-Corona Resource Conservation District Constructed Stream
Photo courtesy of The Riverside-Corona Resource Conservation District



of a wetland plant nursery and research cells; then, the large demonstration wetlands; and, lastly, the Wetlands Water Education Facility. Multiple groups continue to do research at the site and have produced a number of scientific papers. Nearly 120 species of birds have been identified in the wetlands area. In fact, this wetland area boasts 10-15 percent of the entire world population of tri-colored blackbirds, and was crucial in preventing the listing of this species. The multipurpose wetlands are managed to reduce nitrates, create habitat, and provide educational opportunities. Outflow from the wetlands is used for irrigation at nearby farms, a duck club, and at the San Jacinto Wildlife Area.

Riverside-Corona Resource Conservation District Constructed Stream

The Riverside-Corona Resource Conservation District has constructed a native fish stream and associated riparian area and rearing tank facility. The native fish stream is a 300-foot recreated stream habitat with four swirling pools lined with boulder, cobble, and gravel bottoms along its length. Native streamside vegetation and trees add to the local, native riparian ambiance and shade the larger pools to reduce daytime water temperature and reduce algae growth. Four pools average in size from 15 to 20 feet in length and up to five feet in depth, comprising 50 percent of the streams one-quarter acre surface area. Native fish that currently populate the stream are the Santa Ana sucker, arroyo chub, and the speckled dace. The sucker has been recently introduced and is a threatened species that needs flowing water with a gravelly substrate for feeding and reproduction. The dace uses both the pools and the stream sections, and the chub prefers the more tranquil water of the pools. All fish species require high water quality and algae on the rocks for feeding.

Future Wetland Projects within Santa Ana Watershed

SAWPA and its member agencies are committed to assist with the planning and implementation of native and treatment wetlands within the Santa Ana Watershed. Approximately 20 wetland projects were identified during scoping meetings or in response to SAWPA's request for wetlands projects watershed-wide. This list is not intended to be exhaustive, but as a snapshot of wetland projects submitted prior to release of this Plan. (Refer to Figure 3-6, Wetlands Projects Map and Table 3-9, Projects and Opportunities). Additional potential constructed wetland sites, as identified by OCSD, include Talbert Marsh and the Santa Ana River ocean outlet.

The following projects were identified in the IWRP and are included here as a sample of the types of wetlands projects undergoing planning within the watershed.

Hidden Valley Wildlife Area—The Hidden Valley Wildlife Area (HVWA), located in Riverside, California, consists of over 1500 acres of parkland. Through the cooperative efforts of several agencies and citizen groups the Hidden Valley Wetlands Enhancement Project (WEP) has become an environmental asset that promises to provide the community with years of recreation, education, research, and water quality improvements.

The project is a unique example of inter-agency cooperation meeting the collective goals of the community. HVWA now supports multiple benefits:

- Restoration of high quality riparian habitat (supporting native and transient migratory wildlife)
- Reliable water supply for wetlands ecosystem



- Local groundwater recharge
- An interpretive center for environmental education
- Trails for recreation and equestrian activities
- Mitigation of non-native vegetation, wildlife protection, all with the coordination of local agency resources

Irvine Ranch Water District Natural Treatment System—This IRWD project would serve as an alternative for handling dry weather runoff intended to provide new community resources, riparian habitat, and water quality benefits throughout the watershed. Low-flow natural and urban runoff, as well as smaller storm flows, will be diverted into man-made wetlands throughout the San Diego Creek Watershed where contaminants will be removed and prevented from reaching the Upper Newport Bay.

Upper San Jacinto Watershed Nutrient Control—This potential LESJWA program could provide improvements to the upper portions of the San Jacinto Watershed through construction of wetlands, levees, flood control structures, debris basins, and retention basins. Nutrient control in the upper watershed would improve water quality throughout the watershed, including Lake Elsinore at the bottom of the San Jacinto Watershed. The proposed wetlands could be described as flow-through wetlands that would provide both habitat enhancement and nutrient removal to the San Jacinto River.

Implementation

1. When siting treatment wetlands, project proponents should take care not to destroy valuable native riparian habitat.
2. Native and treatment wetland projects should be designed to serve as multi-

benefit projects in addition to improving water quality, including increased habitat value, improved aesthetics, and expanded recreational opportunities, hiking trails, educational components and opportunities for observation (where feasible).

3. Desirable wetland projects are those that address as many improvements as are obtainable (e.g., wetland habitat, water quality, treatment, aesthetics, etc.)
4. Wetland projects should be designed to be durable and either resistant to potential flood damage or quickly recoverable after flooding.
5. Wetland projects should be designed to minimize the production of vector species.
6. Wetland projects should be designed to be low maintenance.

2. Removal of Invasive Species

“We hope that *Arundo* is something that you’ll have to go to a botanic garden to show your children.”

—Jeff Beehler, Santa Ana Watershed Project Authority, August 14, 2002

Biology of *Arundo donax*

Of the many nonnative species that have invaded the riparian forests of Southern California, *Arundo donax* (giant reed) is particularly problematic due to its ability to rapidly invade and colonize new areas and outcompete native species. Although *Arundo* is thought to have originated in freshwaters of eastern Asia, extensive cultivation has occurred throughout Asia, southern Europe, North Africa, and the Middle East for thousands of years. *Arundo* is a hydrophilic (water-loving) plant that grows within the riparian zone of lakes, streams, rivers,



and in other moist soils. It requires moist soils and large amounts of water to sustain its high growth rates of up to 2 inches per day, using more than 528 gallons of water per year for each meter of standing *Arundo*. This water uptake rate roughly equates to three times the amount of water used by native Southern California riparian vegetation.



This monotypic stand of *Arundo donax* provides poor quality habitat for native wildlife species.
Photo courtesy of SAWPA.

Distribution and Removal Efforts of *Arundo donax* in Santa Ana Watershed

Arundo infestation within the Santa Ana Watershed is extensive (see Figure 3-1) and removal efforts began in 1988. The numerous parties making up Team *Arundo* within the Watershed are clearing *Arundo* from many areas, including the upper tributaries of the Watershed. Table 3-1 lists *Arundo* distribution and historical specific removal efforts within the Watershed, as described by Neill and Giessow (2001). Appendix A provides further information. By providing necessary funding, the SCIWP *Arundo* Removal Program will greatly accelerate *Arundo* removal efforts within the Watershed.



This *Arundo* infestation at Hidden Valley Wildlife Area has been targeted for removal by the County of Riverside Park and Open Space District.
Photo courtesy of SAWPA.

SCIWP *Arundo* Removal Program

Operating within the Santa Ana Watershed and facilitated by the Santa Ana Watershed Project Authority, Team *Arundo* is recognized throughout the State of California as a leader in *Arundo* removal efforts. A number of agencies and organizations compose Team *Arundo*, including the Santa Ana Watershed Association of Resource Conservation Districts (SAWA), the Riverside County Parks and Open Space District, the Riverside County Flood Control District, the Orange County Water District, the Orange County Public Facilities and Resources Department, the Monsanto Company, the Orange County Conservation Corps, and California Conservation Corps. Historically, the Nature Conservancy has also participated in Team *Arundo*. The foresight and leadership of these groups have proven instrumental in elevating the need for *Arundo* removal to an issue of statewide importance. Team *Arundo* efforts have included securing funding, acquiring permits, and development various methodologies for removal. During the summer of 2002, Team *Arundo* produced an *Arundo* Removal Protocol, compiled with input from Team *Arundo* members, that documents *Arundo*



Table 3-1 Distribution of *Arundo donax* and Past Removal Efforts within the Santa Ana Watershed

<i>Watershed Zone</i>	<i>Location</i>	<i>Arundo Abundance / Acres Removed</i>	<i>Removal Agency / Organization</i>	<i>Removal Timeframe</i>
Cajon Wash	Lost Lake and below Highway 38	Abundant to scattered	Inland Empire West Resource Conservation District (RCD)	1999-2000
San Bernardino Area	Downstream areas of Waterman Canyon, Hot Springs Creek, and East Twin Creek	Continuous stands, except along City Creek, where Arundo is absent in National Forest to Highland Boulevard, below which scattered clumps are present.	N/A	N/A
San Timoteo Canyon	Near Highway 60 below the City of Beaumont	11 miles of riparian corridor cleared near Alessandro Road, plus most of Live Oak Canyon cleared through Yucaipa	East Valley RCD	1996-2000
Riverside Area	Various	1 mile cleared Near Van Buren Bridge. 7 acres removed at Fairmount Park, 16 acres removed at Alessandro, 10 acres removed at Castle View, 25 acres removed at Woodcrest, 5 acres removed at La Sierra Creek, 16 acres removed at Golden Star Creek	Riverside County Parks and Riverside-Corona RCD	1993-2001
San Jacinto River	San Jacinto Valley below Saboba Reservation	Arundo absent from Idyllwild and National Forest land.	San Jacinto Basin RCD and Washburn Grove Management	1998-2001
Temescal Canyon	Downstream from Lake Elsinore and Lake Corona.	220 acres removed. Arundo absent from Walker Canyon. Arundo becomes present below Lake Corona and near El Cerrito. Quarter mile reach cleared near El Cerrito	Riverside-Corona RCD, Glenn Lukos and Associates and Canyon Landscaping	1997-1998
Prado Basin	Along River Road Bridge	30 acres removed above River Road Bridge	Riverside-Corona RCD	1993-2002
Santa Ana Canyon	Near Featherly Regional Park	60 acres removed on north side of Featherly Park. Arundo remains in central part of flood channel	Orange County staff and Orange County Conservation Corps	1989-2000
Carbon Canyon	Along Carbon Creek	2 acres removed along Carbon Creek. No Arundo within Telegraph Canyon in Chino Hills State Park	Chino Hills State Park staff and Chino Fire Dept.	2000
Santiago Creek	Silverado Canyon area	2 miles private property cleared along Silverado Creek. Arundo present in Modjeska Canyon	Silverado Canyon residents and County staff	1997-1998
Aliso Creek	Whiting Ranch Park	2 sections of Aliso Creek cleared in Whiting Ranch Park	Orange County employees	Late 1990s
Arroyo Trabuco	Holy Jim Canyon and O'Neill Regional Park	Upper two miles in O'Neill Park cleared. Much Arundo in Holy Jim Canyon.	County staff	2000-2001
San Juan Creek	Caspers Regional Park, San Juan Capistrano	Hot Springs area cleared. Area between La Novia Ave. and I-5 cleared but not maintained, and Arundo has invaded.	Orange County staff and prison crews	1995, 1997-1998

SOURCE: Neill and Giessow, 2001 and Riverside-Corona RCD, 2002, personal communication



removal as practiced in the Santa Ana Watershed. The protocol is included in this document as Appendix C and is available on-line at www.sawpa.org/Arundo/index.htm.

Through Southern California Integrated Watershed Program funding, the Riverside County Regional Park and Open Space District will remove *Arundo* from the Santa Ana River between the Mission Inn Boulevard Bridge and the Hidden Valley Wildlife Area during the first two years. The Santa Ana Watershed Association of Resource Conservation Districts (SAWA) will remove *Arundo* from the San Jacinto River, Redlands Zanja, Mill Creek (East Valley), Santa Ana River Phase I area, East Twin Creek, Temescal, Santiago Creek, and Warm Creek during the first year. SAWA will remove *Arundo* from Highland, San Timoteo Creek, Juniper Flats, Mockingbird Canyon, Bedford Canyon, and the Santa Ana River Phase II area during the second year. During the third year, SAWA will remove *Arundo* from Mill Creek (Inland Empire West), Mystic Lake, and Santa Ana River Mainstem Reaches 3 and 4. Additionally, SAWA plans to remove further *Arundo* from Mystic Lake and the Santa Ana River during the fourth year and from the San Jacinto River and the Santa Ana River during the fifth year. The Orange County Public Facilities & Resources Department may remove *Arundo* from the Santa Ana River canyon in the Yorba Linda area during the first three years, from Weir Canyon Road to the Orange County line. The Orange County Conservation Corps may remove *Arundo* from Featherly Park in Orange County during the second year of the program. Another agency, likely the Orange County Water District or SAWA, will remove *Arundo* from other upper Watershed areas and isolated tributaries in San Bernardino and Riverside Counties. In addition, the Riverside County Flood Control District will remove *Arundo* through the Arundo Removal Program.

Other Invasive Species

In addition to *Arundo*, team members may remove other invasive species while undertaking *Arundo* removal activities. These species include, but are not limited to, tree of heaven (*Ailanthus altissima*), tamarisk or saltcedar (*Tamarix* sp.), artichoke thistle (*Cynara cardunculus*), castor bean (*Ricinus communis*), tree or wild tobacco (*Nicotiana glauca*), and perennial pepperweed or tall whitetop (*Lepidium latifolium*). These species disrupt natural ecosystems by competing with native flora for limited resources and generally providing poor quality habitat for native fauna.

Like most invasive species, tree of heaven is known to establish in disturbed areas such as roadsides, highway medians, and vacant lots in urban areas. Tree of heaven spreads via seed dispersal, and once established can grow 40 to 60 feet. These shade-tolerant trees produce toxins that prevent the establishment of other plant species. Tree of heaven is very difficult to remove. Salt cedar also reproduces via seed dispersal and, like tree of heaven, is a prolific seed producer. Like *Arundo*, salt cedar presents a significant fire hazard and consumes much more water than native vegetation. One unique characteristic of salt cedar is that the plant is known to increase soil salinity by absorbing salt from the surrounding soil, then concentrating salt in the area around the tree. Increased concentrations of salt often preclude establishment of other species near salt cedar. Artichoke thistle is an herb that invades grasslands, particularly disturbed areas such as areas associated with overgrazing. Artichoke thistle, which also reproduces via wind-dispersed seeds, is closely related to the commercially cultivated globe artichoke. Castor bean, a woody herb that may reach 15 feet outdoors, is grown as an ornamental in gardens, sometimes as a houseplant. Castor bean is highly toxic to



humans and other animal species. The bean itself has the highest concentration of toxins and likely to be fatal if ingested and the outer shell is broken or chewed open, particularly if ingested by a child. However, castor bean is also the source of castor oil, a traditional remedy for gastrointestinal ailments and absent of toxins. Tree tobacco is also toxic to humans, although not as toxic as castor bean. This plant, known for its elongate yellow flowers, can grow up to 10 feet. Tree tobacco is closely related to domestic tobacco cultivated throughout the southeastern United States for use in cigarettes, but its leaves release toxins when burned.

Consequences of *Arundo donax* Invasion

“More than 95 percent of the historic riparian habitat in the southern part of the state has been lost to agriculture, development, flood control, and other human-caused impacts. The greatest threat today to the remaining riparian corridors is the invasion of exotic plant species, primarily giant reed (*Arundo donax*).

—Excerpt from the Environmental Assessment for the Santa Ana Watershed Program by Dick Zembal and Susan Hoffman (2000)

Given that less than 5 percent of historic riparian habitat in Southern California remains today, the invasion of exotic plant species dramatically threatens remaining habitat. As a result of past and present introductions, its ability to colonize new areas relatively easily, and its ability to outcompete native species, *Arundo* has infested nearly every drainage system in the southwestern United States.

Arundo competes with native species, such as willows (*Salix* sp.), mulefat (*Baccharis* sp.), and cottonwoods (*Populus* sp.) that provide nesting habitat for threatened or endangered species

such as least Bell’s vireo (*Vireo bellii pusillus*), southwestern willow flycatcher (*Empidonax traillii*), and countless other native species. *Arundo* inhibits seedling recruitment of native riparian species, outcompetes established native species, and uses large amounts of water that would otherwise be available to native plants and surrounding areas.

Ecosystem Dynamics

Disturbance within the River floodplain has favored the fast-growing *Arundo* over native riparian vegetation. *Arundo*-infested acreage increases each year in response to annual flood events, fires, and other ecological perturbations. *Arundo* readily invades native riparian communities at any stage of succession, in addition to invading after floods and fires. Because of these characteristics, once *Arundo* becomes established in a riparian area, it alters the ecosystem by redirecting the succession of the community towards pure stands of *Arundo*.



Arundo fueled fire near Hidden Valley Wildlife Area cleared an estimated 200 acres of Arundo.

Photo courtesy of Riverside Co. Park and Open Space District.

Risk of Fire

Arundo is highly combustible, increasing fire frequency and intensity. For example, a single fire in April 2002 swept through approximately



200 acres of riverbed near Martha McLean Anza Narrows Park in Riverside County. Although the cause of the fire is unknown, the flames were fueled by extensive stands of *Arundo*. Unfortunately, removal of *Arundo* by wildfires is not permanent and does not constitute a “silver lining” to these fires. One and half months after the Riverside fire, the burned *Arundo* had resprouted to about 3 feet.

Flooding Issues

By virtue of its great biomass, rapid growth, and dense, interconnected root masses, *Arundo* poses a substantial flood management problem. Floodwaters strip portions of the standing crop of *Arundo* and root masses from the substrate and these mats combine with trash and other debris to form substantial debris dams. In contrast, native riparian species tend to bend rather than break during high flows, greatly reducing the amount of vegetative debris washed downstream. Heavy rains wash debris dams of *Arundo* downriver, pushing mats of dense roots and stalks against bridge abutments. These mats can damage the abutments, clog river channels, and re-direct river flows, thereby flooding adjacent lands.

For example, Riverside County’s River Road Bridge near Norco was damaged twice within three years, causing almost \$1 million in damage. The Riverside County Board of Supervisors subsequently authorized \$8 million to construct a new River Road Bridge. Furthermore, as these large quantities of *Arundo* move downstream, they eventually find their way to the ocean, and subsequently wash up on local beaches. The annual cleanup of this debris costs the public millions of dollars each year.



Arundo damaged the River Road Bridge in Riverside County, causing over \$1 million in damage.
Photo courtesy of SAWPA.

Decreases in Water Quality and Quantity

Arundo absorbs a great deal of water through its roots, effectively removing much water from the available supply. Ideally, as *Arundo* is removed, native plants that require less water will replace it. As previously mentioned, it is estimated that native vegetation uses one-third of the water used by *Arundo*. For example, the removal of every 1,000 acres of *Arundo* and subsequent recovery of native vegetation will yield a water savings of approximately 3,800 acre-feet per year. This is enough to supply almost 20,000 urban residents with water annually.

Extensive stands of *Arundo* along rivers lack the dense foliage canopy and habitat complexity of native riparian forests. As a result, near-shore stream habitats lack the shade offered by the native vegetation’s canopy, and water temperatures are several degrees higher than under natural conditions. Higher water temperatures have a direct negative impact on native stream fishes, such as the Arroyo chub (*Gilia orcutti*) and the threatened Santa Ana sucker (*Catostomus santaanae*). Higher temperatures not only increase algal growth and lower oxygen concentration within the water, they can also lead to increased algal



photosynthetic activity that has been found to increase pH levels within the shallower sections of the River. Increases in pH can facilitate the chemical conversion of ammonium (NH_4^+) salts to the toxic nonionized ammonia form (NH_3), resulting in reduced water quality for both aquatic organisms and downstream users.



This Hydro-axe is a common machine used to remove *Arundo*.
Photo courtesy of SAWPA.

Benefits of Removal of *Arundo donax*

Because this exotic plant alters ecosystem dynamics and interrupts and redirects succession, the removal of *Arundo* from the Watershed offers numerous direct and indirect benefits to landowners, land managers, public agencies, and other Watershed residents. These benefits include reduction in risk of flooding and fire, improvements in water quality, increases in water conservation, and restoration of habitat for native species, including several threatened and endangered species.

Riparian vegetation serves as critical habitat for many State- and federally listed threatened and endangered species, such as the least Bell's vireo. Suitable habitat for listed species within the Watershed has been reduced over time by as much as 95 percent and *Arundo* has replaced over 50 percent of the remaining habitat. Preventing

the spread of *Arundo* will preclude the further deterioration of habitat for many of the sensitive, threatened, and endangered riparian species. As areas of *Arundo* are removed and converted back to native riparian habitat, rare species will be able to expand their populations throughout the Santa Ana River Watershed. Replacing these stands of exotics with native riparian vegetation will, in time, result in sufficient overhanging foliage to provide the necessary cooler water temperatures, bank cover, and improved water quality needed to protect populations of native fish species and other aquatic organisms.

In addition, *Arundo* removal would result in more in-stream water for both residents of the Watershed and the native aquatic organisms. Given that the costs associated with providing imported water to residents will only increase over time, the savings to the water suppliers, and ultimately to the Watershed residents, would be substantial.

Methods of *Arundo* Removal

Removal of *Arundo* can be accomplished by a variety of methods. Each method differs in cost, time, and can be specific to certain areas or types of infested habitat. Removal methods include mechanical removal, chemical control, and biological control, in addition to a comprehensive integrated weed management approach. Prevention of further invasion or reinfestation should also be considered in conjunction with removal methods.

Combination of Mechanical Removal and Foliar Spraying

One common method of removal used by Team *Arundo* members involves a combination of mechanical removal and foliar spray. Crews will chip or cut *Arundo* stalks, then return two to four weeks later when the plants are between 2 and 4

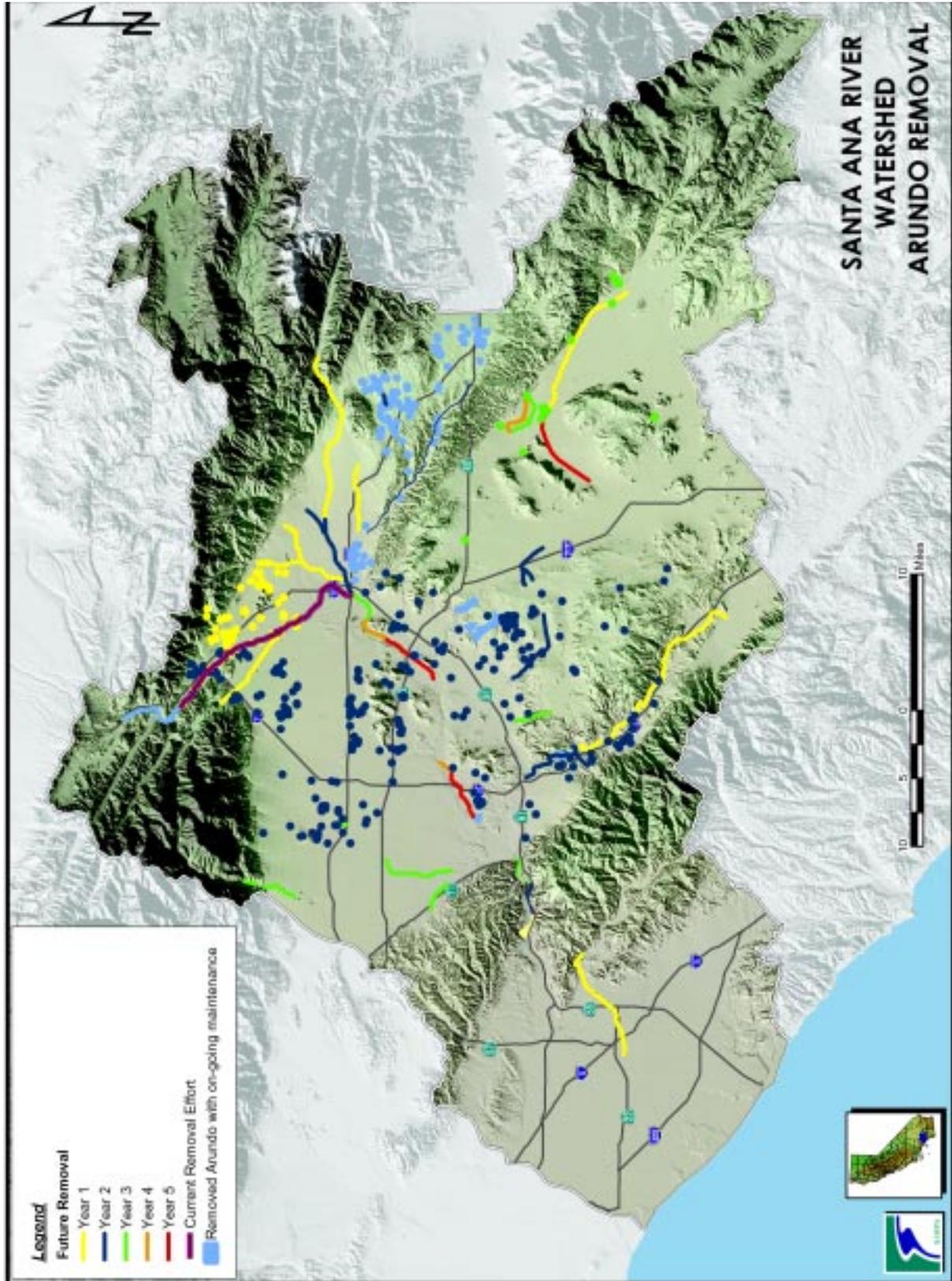


Figure 3-1 Arundo Removal within the Watershed



feet tall to apply a foliar spray solution of a glyphosate-based herbicide. The primary advantages of this method is that the amount of herbicide used on the fresh growth is greatly reduced from that used on the 30 to 40-foot-tall *Arundo* stalks (as with full foliar spraying), and that herbicide coverage is better when the stalks are shorter and of a uniform size. One drawback associated with this method is that cutting the stalks induces the plant to re-enter the growth stage, thereby causing it to translocate less of the herbicide to the roots and rhizomes. However, as with most removal methods, supplemental treatments are generally required in *Arundo* removal, and total root kill is almost never achieved with a single application of herbicide when the plants are already established.

Integrated Weed Management

The Integrated Weed Management (IWM) approach most closely describes Team *Arundo*'s overall methodology. IWM is defined in the federal Noxious Weed Act as, "a system for the planning and implementation of a program, using an interdisciplinary approach, to select a method for containing or controlling undesirable plant species or groups of species using all available methods, including education, prevention, physical or mechanical methods, biological control agents, herbicide methods, and general land management practices." The goal of IWM is to minimize the impact of control actions on the nontarget environment and public health while maximizing the effectiveness of practical control methods. Team *Arundo* members combine mechanical control and chemical control, and strives to incorporate elements from IWM such as landowner and nursery education. Landowner education is important to discourage landowners from planting new *Arundo* in their yard and to encourage them to eradicate current stands,

while nursery education is important because it is still legal to sell *Arundo* within the State of California. Both SAWPA and SAWA have produced educational brochures for homeowners about the impacts of *Arundo* and SAWPA has produced a PowerPoint presentation targeting nurseries to discourage the sale of *Arundo*.

IWM includes "cultural methods" of exotic species invasion prevention, which involve the modification of human behavior both within and around the area of infestation. Recreational, economic, and urban land uses that contribute to the introduction and proliferation of invasive species are discouraged by this method. Within the Santa Ana Watershed, behavioral modifications include altered planting practices that encourage the use of native plant species for landscaping, rather than *Arundo* or other exotic species. Other native or less invasive species can be substituted for bank stabilization and aesthetic purposes.

Arundo disposal

Cut *Arundo* may be removed from treatment areas through burning, chipping, or vehicular transportation. The removal of the cut cane is important due to the untreated cane's ability to re-root and colonize new areas either at the site or downstream (if washdown occurs). Although burning is the most cost effective method to dispose of the dead cane, Team *Arundo* members seldom burn cane due to environmental considerations and requirements for AQMD permits. Cutting, chopping, and chipping is the most common method of disposal, with Team *Arundo* members using this method to dispose of 80 to 100 percent of the cut biomass. If chipped and left on site, pieces of cane should be chipped to about ¼ inch to 1 inch to prevent resprouting.



Chipping of *Arundo* after removal is necessary to prevent resprouting.
Photo courtesy of Inland Empire West Resource Conservation District.

One company in California spent five years on research and development to determine the commercial viability of *Arundo* as an alternative to wood pulp. This company has produced the first commercial run of bleached *Arundo* pulp and has shown an interest in taking *Arundo* from removal projects. Producing 300 tons of pulp per month would require about 8,000 tons per month of green *Arundo* chips (equivalent to 400 semi-truck loads). Disposal of chipped *Arundo* though recycling for paper is desirable as it provides fiber for a sustainable tree- and chlorine-free product and minimizes potential impacts associated with stockpiling *Arundo*. However, certain issues must be considered, such as preventing the accidental spread of *Arundo* during transport and the sustainability of the industry once all of the *Arundo* has been removed.

“It takes 250,000 acres of trees to provide the same amount of pulp provided by 25,000 acres of *Arundo*.”

—Fred Martin, Samoa Pacific, Cellulose, LLC

Permitting for *Arundo* removal

Applicable permits and regulatory compliance are measures identified in Table 3-2. While implementing the *Arundo* Removal Program, specific impact avoidance measures described in each permit must be followed. Obtaining current permits and adhering to the permit requirements are the individual responsibility of each Team *Arundo* member. According to federal law, herbicide applicators must comply with the label requirements and instructions for each herbicide used. Appendix C of the *Arundo* Removal Protocol contains the labels and material safety data sheets (MSDS) for herbicides commonly used for *Arundo* removal within the Santa Ana Watershed. The MSDS provides information to supplement label requirements, such as toxicity and ecological data.

Invasive Species to Watch

Perennial Pepperweed—The Next *Arundo*?

Although extensive removal efforts within the Santa Ana Watershed have not focused on perennial pepperweed (*Lepidium latifolium*), this plant has been identified as a potential threat to the Watershed. Perennial pepperweed, also called tall whitetop due to its thick clusters of white flowers, reproduces by sprouting new shoots off existing roots. However, the plant also produces up to 6 billion seeds per acre, which are spread by forces of nature such as wind and water over great distances and allow the plant to colonize new areas. Although not nearly as pervasive (yet), pepperweed has been referred to as “the next *Arundo*.” Like other invasive species, pepperweed harms native flora and fauna by outcompeting native species, forming a monoculture that is inhospitable to native and special status wildlife species such as the least Bell’s vireo.



Table 3-2. Permitting and Regulatory Compliance Required for <i>Arundo</i> Removal within the State of California			
Law or Regulation	Regulating Agency	Applicable Document	Type of Permit Required
Federal Insecticide, Rodenticide, and Fungicide Act (FIFRA)*	US Environmental Protection Agency	Herbicide product label and MSDS sheet	No permit needed; herbicide applicators must comply with herbicide labels
National Pollution Discharge Elimination System NPDES*	State Water Resources Control Board	Water Quality Order No. 2001-12-DWQ: Statewide NPDES Permit for Discharges of Aquatic Pesticides to Surface Waters of the United States	This General Permit applies to entire State of California. However, General Permit users must file a Notice of Intent to Comply with the Terms of the NPDES General Permit
California Food and Agricultural Code *	California Department of Pesticide Regulation	Qualified Applicator's License and/or Qualified Applicator's Certificate	Statewide, a permit is needed only for restricted use materials (glyphosate is not a restricted use material. However, confirm with local County Agricultural Commissioners as local regulations can vary).
California Environmental Quality Act (CEQA)	Governor's Office of Planning and Research, State Clearinghouse	Categorical Exemption	Individual; SCIWP <i>Arundo</i> removal occurs under Categorical Exemption filed by SAWPA
California Fish and Game Code Section 1603	California Department of Fish and Game	Lake or Streambed Alteration Agreement	Individual (agencies removing <i>Arundo</i> must negotiate this permit)
Federal Clean Water Act, Section 401	California Regional Water Quality Control Board	Clean Water Act Section 401 Water Quality Certification	Individual (agencies removing <i>Arundo</i> must negotiate this permit)
Federal Clean Water Act, Section 404	US Army Corps of Engineers	Regional General Permit No. 41 for Removal of Invasive, Exotic Plants	General Permit No. 41 covers Southern California (Los Angeles District)

*Applies only to *Arundo* removal involving herbicide application



Perennial pepperweed, shown here while flowering, has been called "the next *Arundo*"

Photo courtesy of Jesse Giessow, Santa Margarita and San Luis Rey Watersheds Weed Management Area

According to an informal field survey performed during June 2001, pepperweed is dominant in open riparian areas near Chino Creek at Euclid and on the north side of Prado Basin. Isolated patches are present near Van Buren Bridge in the City of Riverside. Small populations are present below Prado Dam and at Rancho Jurupa Park. The plant is also present near Temecula in the Santa Margarita watershed. Pepperweed is a hardy plant; it's invaded all western states except Arizona. Pepperweed has been found to invade after removal of other invasive species, such as *Arundo*. Given that the purpose of invasive species removal is to encourage reestablishment of native vegetation and to avoid a monoculture of invasive species, the invasion



of new invasives following removal of other species should be strongly monitored and management measures should be taken to avoid such a situation.

Implementation

The following implementation measures are offered to achieve invasive species removal goals. Removal of invasive species is vital to habitat restoration and improvement of ecosystem function. Given the rising cost of land acquisition in Southern California, restoration of habitat is less expensive than and equally important to acquiring further habitat. Removal of invasive species is an excellent way to increase ecosystem function.

1. Continue seeking funding for further removal of *Arundo* and other invasive species and long term monitoring of previous removal efforts.
2. As groups remove *Arundo* within the watershed, post-removal monitoring should include identification, documentation, and removal of perennial pepperweed for a minimum of three years. This recommendation is crucial for the Hidden Valley area to prevent spread of pepperweed to the Riverside County Parks land above Van Buren Bridge. Control of the species below Prado Dam is crucial to prevent spread to the Orange County River Channel.
3. Facilitate other groups beyond Team Arundo to perform removal and maintenance.
4. Facilitate efforts by agencies and groups who maintain the river.

3. Increasing Connectivity of Regional Trail System

“The common link connecting all of the projects that we’ve discussed today is the Santa Ana River Trail. This trail is the golden thread running throughout planning efforts within the watershed.”

—Jonathan Jones, City of Corona, Santa Ana Scoping Meeting, July 26, 2002

As explained in Section 2C, Open Space and Recreation, several segments of the Santa Ana River Trail totaling approximately 40 miles have been constructed, out of 110 miles of total trail length. Conceptual plans are basically complete for the remaining 70 miles (as well as a number of feeder trails and connections) and full funding has been secured for some segments. Refer to Figure 3-2 for a map of the current status of the Santa Ana River Trail, including planned segments. One goal of the Santa Ana Integrated Watershed Plan is to assist in securing funds for those trail segments that have not yet received funding. Trail status is most easily discussed by county, as follows.

Orange County—The backbone of the Santa Ana River Trail is basically complete through Orange County, from the mouth of the Santa Ana River to the Orange County line. However, parts of the trail are in need of aesthetic improvements, as the trail runs along a dry concrete channel for much of the Orange County portion. At the mouth of the River, the trail connects very smoothly to the Pacific Coast Trail, which runs along the beach from Sunset Beach to Balboa Beach. In Orange County, the trail allows access to Arrowhead Pond, a large sporting event and concert venue, home to the Mighty Ducks of Anaheim Hockey Team, and Edison Field, home to the Anaheim Angels Baseball

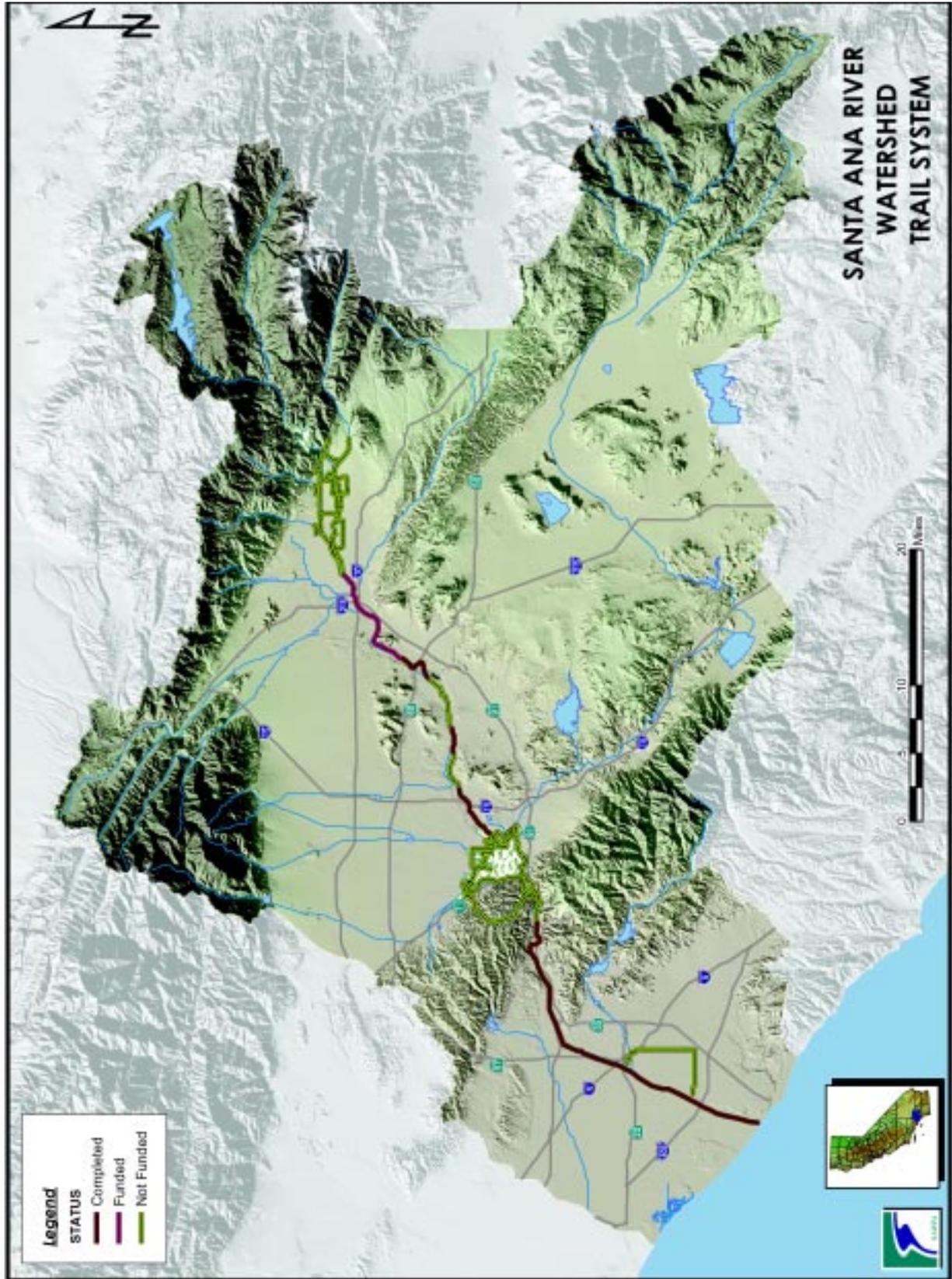


FIGURE 3-2 Santa Ana Watershed Trail System



Team. The proximity of the Trail to these event centers provides a unique opportunity for trail usage; event attendees could make use of the trail to avoid traffic and parking fees.

The following statements are based on the original 1990 Santa Ana River Trail Plan and modified according to recent input.

The goal of the Santa Ana River Trail and Parkway project is to develop a continuous multi-use regional trail system and parkway along the Santa Ana River corridor. In support of the overall goal, planning and implementation activities will accomplish the following objectives:

1. Provide for a continuous, safe trail linkage system.
2. Provide trail linkage to feeder trail systems.
3. Provide multi-use, barrier-free trail opportunities within the trail system.
4. Provide environmental education opportunities within the trail system.
5. Provide protection of the natural resources for the Santa Ana River corridor through operation and management guidelines.
6. Provide new park facilities and upgrade interfaces with existing parks as needed at appropriate intervals along the river corridor
7. Provide interesting venues for interaction with the community and commercial interests along the river corridor.

The trail in Orange County is dual use for much of the route, with an unpaved hiking/equestrian trail running next to the Class I bikeway (a Class I bikeway provides a completely separated right-of-way for the exclusive use of bicycles and pedestrians with cross-flow of motorized traffic minimized). However, the unpaved portion is not contiguous and does not run all the way to the Pacific Ocean. Although there are a few equestrian features, such as unpaved paddocks that serve as “rest areas” for horses, regional equestrians see the need for more equestrian staging areas. Also, equestrian trails are viewed as ephemeral, highlighting the need to ensure permanent easements for equestrians to access the Riverbed.

Tri-County Area—The tri-county area, at the intersection of Orange, Riverside, and San Bernardino Counties, includes one of the largest challenges for completion of the trail. A major “missing link” in the trail is the area around Prado Dam and Prado Wetlands. A large loop around Prado Dam is planned, but funding has not yet been secured for this section, which will be primarily constructed through Riverside County. Planning of this trail segment must be coordinated with the U.S. Army Corps of Engineers in accordance with the agency’s plans to raise Prado Dam, as raising the Dam will increase the area of the flood basin. In addition, trail planning through this area is difficult due to the large amount of restricted habitat and the high number of special status species in the vicinity of Prado Basin. Please refer to Figure 3-3 for a map of the conceptual trail loop around Prado Wetlands.

Riverside County—Completing the trail through Riverside County may prove to be more challenging than in Orange County or San Bernardino County. In Riverside County, the Santa Ana River runs through three cities after

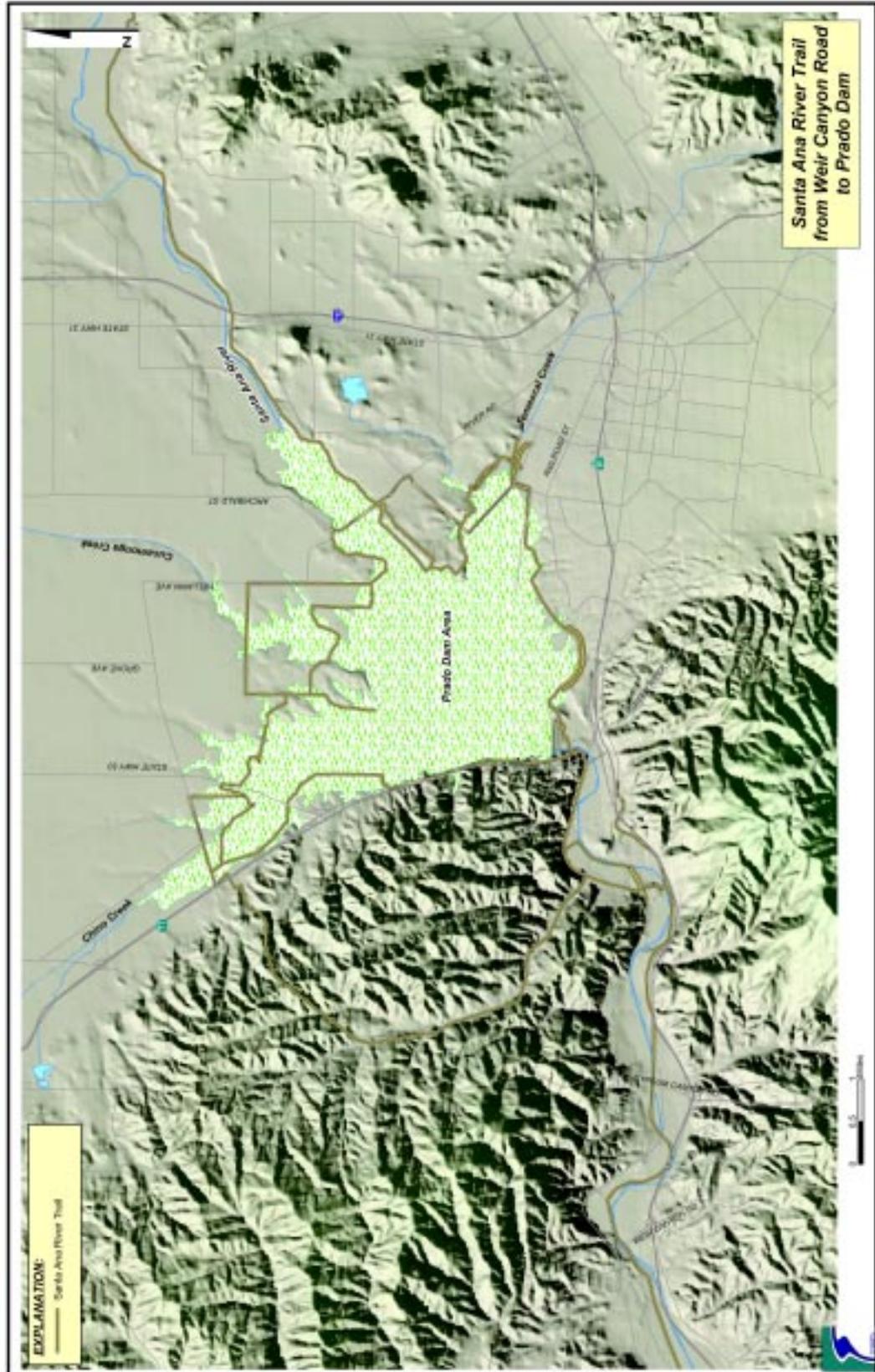


Figure 3-3 Santa Ana River Trail from Weir Canyon Road to Prado Dam



crossing the Orange/Riverside County Line. The trail is in long-term development plans as it passes through the City of Corona and the City of Norco, and the trail is nearing completion through the City of Riverside.

The most comprehensive trail plan to date is the 1990 “Santa Ana River Corridor Trail System,” which predicted that the longer the trail took to implement, the more difficult implementation would be. This statement has proven prophetic in the case of routing the trail from Prado Basin through the City of Corona. A residential neighborhood has been built over the original 1990 plan trail route, and rerouting the trail around the neighborhood would place it in sensitive habitat. An alternative route along Rincon Street looks implausible. Although the road is planned for widening, there is inadequate right-of-way for a bike lane and the road passes through dense riparian habitat under regulatory protection.

Completing the trail through the City of Norco will also prove challenging in many areas, as potential trail sites travel through residential neighborhoods with little to no right of way for a bike path. Two segments along the City of Norco need completion: from Pedley Avenue to Hamner Avenue is likely to be completed before the Hamner Avenue to River Road segment, as the Army Corps of Engineers has recently completed a bank stabilization project and has paved part of the trail.

The City of Riverside boasts a contiguous stretch of trail, starting just west of the Van Buren Bridge at Tyler Street and traveling east for approximately 7.5 miles, ending at Market Street in the City of Riverside. This is a pleasant stretch of trail, passing through Anza Narrows and Mount Rubidoux Parks, ending near Evans Lake in Fairmont Park. Although the trail is not

complete through the City of Riverside, the City has completed planning the unfinished segments and is seeking funding to complete the trail.

San Bernardino County— Currently, there is no official Santa Ana River Trail and Parkway in San Bernardino County. Eighteen miles of the planned trail fall under the jurisdiction of San Bernardino County, from the Riverside/San Bernardino County Line to the boundary of U.S. Forest Service land in the foothills of the San Bernardino Mountains. As the Pacific Crest Trail runs through U.S. Forest Service Land, the U.S. Forest Service has jurisdiction over connecting the Santa Ana River Trail to the Pacific Crest Trail. This connection would provide 35 miles of trail, but may never be paved as a Class I bikeway. Approximately 11.3 miles of the San Bernardino County portion of the trail have been planned in three phases, with the remaining 7 miles still in conceptual stages. Phase I (3.3 miles) has received some funding, but more funding is needed before engineering design can begin. The County has secured funding to complete construction of Phase II, which should begin in Fall 2002. The County has also secured funding for Phase III and engineering design should begin Fall 2002. Much of the future trail in San Bernardino County will be built on existing flood control levees that will require little to no grading and clearing of vegetation. San Bernardino County trail planners have applied to various grant programs to fund the rest of the trail.

Another trail area in San Bernardino County is the California Field Office Rail-Trail Projects Rancho Cucamonga Pacific Electric Trail. The cities of Montclair, Upland, Rancho Cucamonga, Fontana and Rialto have agreed to work together with SANBAG, the San Bernardino Association of Governments to develop a 20-mile trail along the alignment of the old Pacific Electric line from Los Angeles. The route connects with many



schools, shopping districts, and residential areas, and would stretch from Claremont to Rialto. Area trail planners should investigate linkages to connect this trail to the Santa Ana River Trail.

Implementation

Trail Completion

1. Construct those sections of the Santa Ana River Trail for which funding has been secured (namely, Phase I in San Bernardino County).
2. Secure funding for completion of those sections that have been planned: Phases II, III, and IV in San Bernardino County and Phase I: Part 2, Phase IIIB: Part 2, Phase IV, and Phase V in Riverside County (refer to Table 3-3, Status of the Santa Ana River Trail, by County and Segment).
3. Complete other vital links such as Temescal Wash/San Jacinto Wash to San Jacinto Mountains and connections to the new San Timoteo State Park
4. Best utilize up to \$10.0 million in funding provided by Proposition 40 to complete the trail.
5. Employ better communication and integrated review to assist city and county planners in assessing trail impacts when considering proposed projects. Trail users are concerned about pieces of potential trail connections disappearing permanently once development is approved without provision for trails. Therefore, there is a need to coordinate trail planning efforts with other project efforts to avoid conflicting land uses. For example, each county's Parks and Recreation/Trail Planning Department should coordinate with other County and City partners regarding potential projects (e.g., planning and public works projects).

6. Integrate individual cities' trail planning efforts to ensure connectivity and to ensure that the Santa Ana River Trail's usefulness reaches its full potential.
7. Institute a trail overseer role. For example, SAWPA could assist the watershed community in developing a trail overseer role, so that when proposed projects undergo environmental review through the CEQA process, not only will the lead agency/City/County look at trail impacts, but the trail overseer could also do the same.

Amenities

The American Association of Highway and Transportation Officials (AASHTO) and the California Department of Transportation (Caltrans) have developed national standards for bikeways. Caltrans advises that all standards in the Caltrans Highway Design Manual, Chapter 1000: Bikeway Planning and Design be followed, including mandatory and advisory standards. The following are additional recommendations for the Santa Ana River Trail, identified and recommended by watershed participants either in writing or at scoping meetings. These recommendations are intended to complement Chapter 1000 of the Caltrans Highway Design Manual and none of these recommendations shall be interpreted to supersede or conflict with Caltrans standards.

8. Ensure consistent trail mileage. Orange County's mileage system begins with the Pacific Ocean as Mile Zero, and this mileage system should be carried out along the length of the Trail, with the connection to the Pacific Crest Trail approximating Mile 110. A mileage system is important safety issue because it allows users to know their location,



distance traveled, and distance left to travel. In addition, those training for marathons and other fitness events that require specific mileage goals during training may use the trail.

9. Trail should include the availability of water fountains for user refreshment and safety.
10. Trail should include restroom access, such as maintained port-a-potties.



This paddock serves as a “rest area” for horses using the trail
 Photo courtesy of EIP Associates.

11. Trail should include frequent shade trees to provide relief from the sun and heat of inland Orange, Riverside, and San Bernardino Counties. Native species should be used for these shade trees.



Example of dual trail: unpaved horse/hiking trail alongside paved Class I bikeway.
 Photo courtesy of EIP Associates.

12. Trail should include staging areas for equestrian use and paddocks to serve as rest areas for horses.



This interpretive sign alerts Orange County trail users to an osprey nesting platform along the Santa Ana River
 Photo courtesy of EIP Associates.

13. Trail should include bike racks to allow riders to secure bicycles when using trailside amenities.
14. Trail should include ample disposal facilities for garbage, including garbage cans, recycling bins, and elevated “bicycle-friendly” garbage cans that are convenient for bikers to utilize.
15. Trail should include access to air hoses for bikes that need to inflate their tires.
16. Trail should include interpretive signage for environmental and wildlife education.
17. Trail should include some bike ‘n’ hike primitive campgrounds for those interested in biking or riding from coast to crest (these campgrounds should be accessible by foot, not requiring a car). Once challenge in implementing these campgrounds will be security issues, including personal safety and emergency vehicle access.



Other Implementation

- 18. Continue outreach and contact with law enforcement to pursue trail access and safety.
- 19. To draw attention to the trail, its planners should host annual 2-day Bike n’ Ride events with camping on the first night. This event could be timed such that participants could join in at various points along the trail.

4. Multi-objective Conservation Planning and Projects

Key actions to restoring ecological function within the Santa Ana Watershed include habitat acquisition, enhancement, and restoration. Agencies and organizations within the watershed engaged in conservation activities should balance priorities and funding allocation between habitat acquisition and habitat restoration.

Table 3-3. Status of Santa Ana River Trail, by County and Segment

County	Phase	Location	Miles	Status
Orange County	Orange County	Mouth of River to Orange County Line	26	Trail complete through Orange County
Riverside County	Tri-County Area	Orange County Line to Green River Road	1	Trail segment incomplete
	Long-term trail/ bike path	Green River Golf Course to Pedley Avenue in Norco	7	Trail segment conceptual
	Phase V	Pedley Avenue to western edge of Hidden Valley Wildlife Area	1	Trail segment conceptual
	Phase IV	Western edge of Hidden Valley Wildlife Area to Tyler Street	1.5	Planning complete
	Phase IIIB, part 2	Offshoot of main trail along Van Buren to Jurupa Ave. Includes Hole Lake crossing	0.25-0.5	Planning and environmental clearance complete
	Phase I, part 1, to Phase IIIB part 1	Tyler Street to Market Street	7.5	Trail segment complete
	Phase I, part 2	Market Street to Riverside/SB Co. Line	1	Funding secured
San Bernardino County	Phase I	Riverside/SB Co. Line to La Cadena Drive	3.3	Plans complete (but need revision)Some funding acquired Seeking future funding
	Phase II	La Cadena Drive to Waterman Avenue	3.5	Planning complete Engineering designs complete, Funding acquired, Construction starts Fall 2002
	Phase III	Waterman Avenue to Alabama Street	4.5	Plan complete Most funding acquired Engineering design starts Fall 2002
	Remaining trail under SB Co. Jurisdiction	From Alabama Street to US Forest Service Land	11	Trail segment conceptual
	US Forest Service Land	Beyond 7 Oaks Dam	35	Some unpaved mountain bike trail, some conceptual
<i>Total Miles</i>			<i>110</i>	



Recommendation #2: Protect and Restore Habitat Resources

2-A. Restore natural wetland habitats in flood plains of the River and its tributaries.

- Look for opportunities in natural undeveloped areas to add wetlands that will increase complex natural habitats in juxtaposition to the stream system.
- Connect wetlands to the stream corridor through the addition of channels and vegetation.

2-B. Protect and restore remaining native species and habitats.

- Recreate meanders and backwaters where possible within the River and its tributaries to enhance native fish habitat.
- Create drop structures and other oxygenation devices that do not inhibit fish passage.
- Reestablish riffle substrates.
- Develop instream structures to promote pool and flow complexes.

2-C. Identify public and private agencies and organizations to maintain acquired lands and funding sources.

2-D. Acquire key parcels of land for conservation.

- Establish conservation goals and target selection criteria.
- Identify key potential parcels based on selection criteria.
- Negotiate conservation easements as an alternative to outright purchase of lands.

2-E. Promote the identification, establishment, and protection of wildlife corridors.

2-F. Connect upland vegetation and habitats through edge habitats and corridors.

- Locate isolated habitat patches and establish corridors suitable to increase the habitat diversity available to all species.
- Plant native trees, shrubs, and forbs to establish wildlife-friendly pathways along roads and channels.

2-G. Remove and control exotic species.

- Continue active programs for removal of established invasive species.
- Identify and control recently established invasive species to prevent further spread.
- Prevent introduction of future invasive species.

Habitat Acquisition

Several areas within the watershed offer excellent opportunities for habitat acquisition, enhancement, and restoration. Watershed planning participants recognize that habitat acquisition is equally important as habitat restoration. As the watershed continues to urbanize, land values are expected to rise, increasing the difficulty of land acquisition with each passing year. Refer to Figure 3-4 for a map of potential resource conservation areas within the watershed, as determined by representatives from community-based organizations, cities, counties, State Parks, and the California Coastal Commission.

Ideally, the parcels of land targeted for preservation will help to connect open space, link



existing recreational trails, increase public access to water, provide habitat, protect wildlife corridors, positively contribute to groundwater recharge, and prevent development in environmentally sensitive areas. Alternatives to land acquisition include the negotiation of conservation easements whereby the lead agency or organization for the land acquisition project does not gain *fee simple* property rights (full ownership). Through these types of agreements, private property owners retain ownership of their land, but surrender some of their property rights, such as the right to develop the property, in exchange for federal income and estate tax advantages. Implementation of conservation easements is generally much less expensive than purchasing a property outright. Refer to sample Conservation Easement Deed issued by California Department of Fish and Game, Appendix G.

Habitat Restoration and Enhancement

Restoration strategies include invasive species removal, debris removal, wetlands enhancement, beach renourishment, and revegetation projects. Potential restoration projects include culvert daylighting, as discussed in section 2G, Flood Control. In addition to restoring ecological function, appropriate implementation of these restoration activities can prevent listing of threatened or endangered species, as well as providing economic and other benefits to the region. Economic and public safety benefits of removing invasive species are discussed in Section 3A-2, Invasive Species Removal. Additionally, beach renourishment provides recreational and economic benefits to the region.

Beach Renourishment

Beach renourishment is an economically important restoration strategy that has become necessary within Southern California. Coastal streams and rivers provide 70 to 90 percent of California’s beach sand, with the remaining 10 to 30 percent provided by gully, terrace, and bluff erosion. Flood control measures such as

ESSENTIAL RESOURCE CONSERVATION AREAS

Source: Watershed Stakeholders, SAWPA Scoping Meeting, August 14, 2002

1. Santa Ana River Mouth to Fairview Park
2. Bolsa Chica Wetlands
3. Upper Newport Bay
4. Lower Newport Bay
5. Santiago Creek
6. Temescal Canyon
7. Palomar- Santa Ana Mountains linkages
8. Featherly Park
9. Prado Basin
10. Coal Canyon
11. City of Chino- Sphere of Influence
12. Box Springs Mountains
13. San Timoteo Canyon
14. Carbon Canyon Creek
15. Connection from City of Whittier to Chino Hills State Park
16. Lytle Creek
17. Mystic Lake



LAND ACQUISITION TARGET SITE SELECTION

The following outlines steps for targeting specific sites for land acquisition. Source: EIP Associates, 2002

A. Identify clear and concise objectives for selecting target sites

1. What are the intended uses of these sites (e.g., recreation, trails, habitat conservation, groundwater recharge)?
2. Will this site conserve habitat for particular species or at the community level? Which species? What communities?
3. What is the available budget for acquiring and maintaining lands for conservation?

B. Develop criteria for selecting sites based on the stated objectives

1. Work with stakeholders and scientists to create a list of criteria that will be used to select target sites.
2. Some examples of possible criteria that may be used:
 - i. Habitat Conservation*
 - Reserve size: minimum dynamic area required for supporting natural processes, disturbance regimes, recovery from disturbance, and species ranges.
 - Connectivity between target sites for allowing migrations and distribution of genetic material.
 - Uniqueness of species or communities found within a site. Are rare, endemic, or threatened/endangered species found within the site?
 - Anthropogenic threats to the potential sites. For example, is development encroaching on particular sites, suggesting that either the site will be eradicated if not protected *or* that the site is not viable as human pressures will overwhelm natural communities? We might look at the distance of sites from urban sprawl, sites that occur in the urban/wildland interface, etc.
 - What are the specific demands of the species of concern? What types of sites are required to ensure their long-term conservation?
 - ii. Open Space/Recreation/Public Access*
 - Recreational potential of site, including the effect that it would have on conservation objectives
 - Existing land use
 - Connectivity of trail network
 - Accessibility to river, tributaries, and ocean
 - iii. Groundwater Recharge/Water Quality*
 - Runoff estimate and groundwater recharge potential
 - Soil characteristics (permeability/infiltration, erosion hazard, etc.)
 - Effects of upstream/downstream point and non-point source pollutants
 - iv. Wetland Conservation/Enhancement*
 - Acreage and type of existing wetland features
 - Sensitivity ratings of existing wetland features
 - Potential for wetland restoration or enhancement
 - v. Political and Fiscal Feasibility*
 - How much would it cost to conserve a particular site in comparison with others?
 - What are the political hurdles associated with each potential site?

What are the current land use designations for each site, and what value would each site have with other land uses?

- Are conservation easements a potential vehicle for conserving the site?

C. Develop model for optimizing the reserve design based on criteria and available data

1. Which data layers will be used and why?
2. What are the individual parameters for each criterion?
3. What are the assumptions inherent in the model?

D. Conduct analysis and generate maps of alternative target sites

1. Use GIS to evaluate sites based on the selected criteria.
2. Identify several alternative target sites to be presented to SAWPA and relevant stakeholders.

E. Work with stakeholders, scientists, and agencies to identify an optimal group of target sites based on both political feasibility and environmental effectiveness

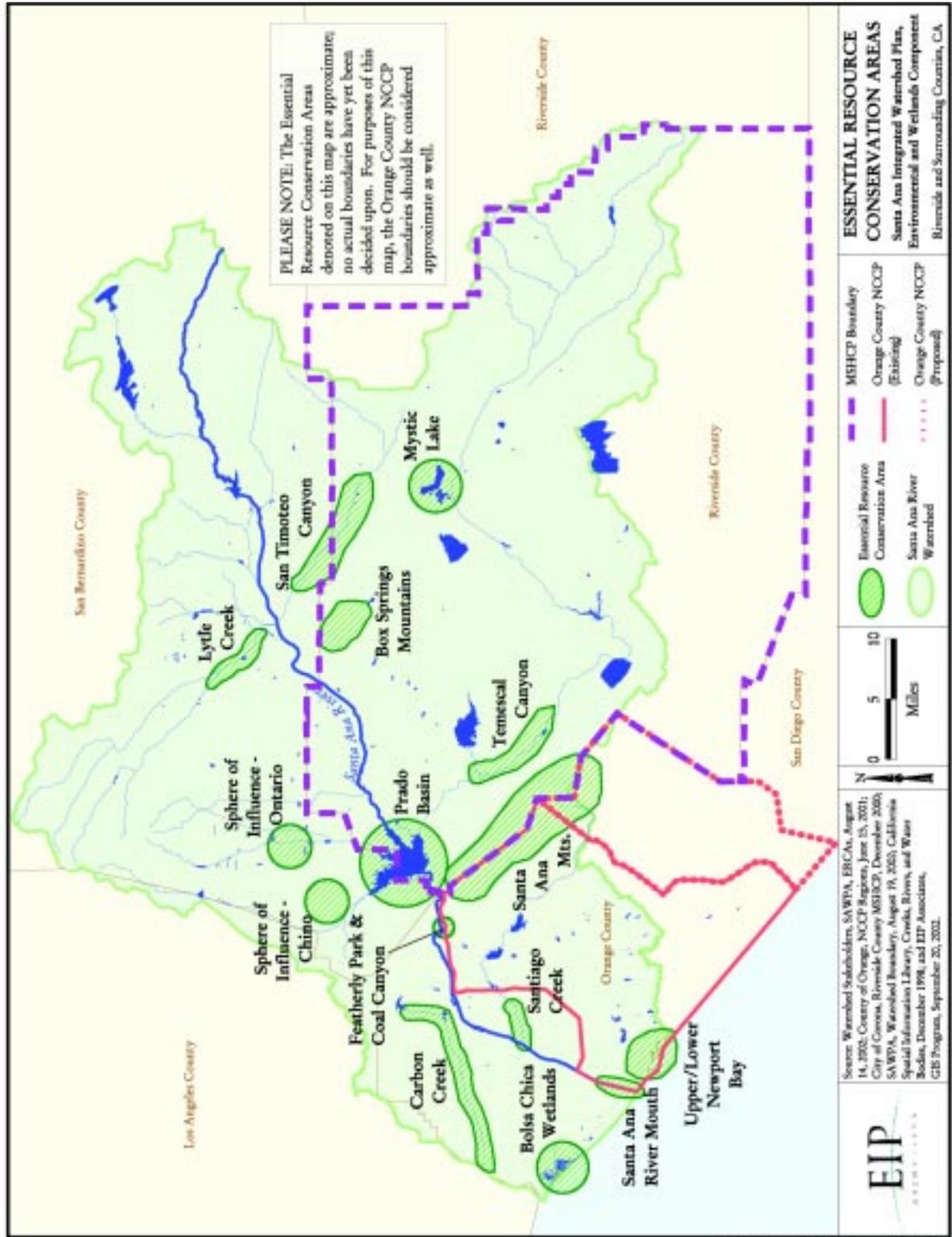


Figure 3-4 Essential Resource Conservation Areas



Huntington Beach, a world-famous surf spot, is an important recreational area for Southern California residents.

Photo courtesy of EIP Associates.

dams, debris basins, and river channelization may reduce the amount of sand reaching the coast, while harbor structures may obstruct along shore sand movement. According to Flick (1993), the most drastic sand deficit in Southern California exists along Orange County's coastline, where the natural sediment supply has decreased up to 85 percent. It is estimated that Prado Dam alone reduces sand and gravel flow by approximately 67 percent each year. According to the U.S. Army Corps of Engineers and the U.S. Interagency Advisory Committee on Water Data, historic sedimentation rates behind Prado Dam have averaged well over 1,000,000 cubic yards per year¹.

Preventing the Listing of Species

With respect to wildlife, it is imperative to focus time, energy, and funding on those native species that are not yet listed as threatened or endangered, such as the speckled dace, a native fish species. Once a species is placed on State or federal lists, engaging in actions that help the species may actually become more difficult due to regulatory requirements. Activities that are beneficial in the long term can often cause short-term disturbances that impede the permitting process when working with threatened and endangered species. Recovery efforts that focus on only one species should be avoided in favor of multiple benefit projects.

¹ Average sedimentation rate from 1941 to 1979 was 1,130,000 cubic yards per year. From 1979 to 1988, this rate was estimated to rise to at least 1,380,000. Although upstream construction of the Seven Oaks Dam, completed in 1999, may have reduced the sedimentation rate behind Prado Dam, total sedimentation rates behind Santa Ana River dams would not have decreased as a result of the Seven Oaks Dam.



Strategies for *thinking ahead* to create a conservation strategy that ensures the long-term viability of the watershed’s native flora, fauna, and aquatic communities will prevent degradation of the watershed’s delicate ecosystem. By overlaying significant resource data such as the Riverside County land acquisition priority map with other watershed studies, better decisions will be made with regard to habitat restoration and enhancement efforts. Planning and discussion amongst key watershed participants will ensure that the best possible targets for restoration land acquisition will be selected.

A related strategy proposed in this plan, which could help to prevent sensitive or threatened species from becoming endangered, would be the creation of an Aquatic Resources Committee (ARC), expanding the role of the Santa Ana Sucker Discussion Group, to include other native fish, for example. While participation in ARC would be voluntary, the objective would be to encourage the active involvement of state and federal resource agencies, cities, counties, other local jurisdictions, and the private sector, in coordinating and developing programs and specific projects focused on preventing future listing of native fish such as the arroyo chub and the speckled dace. Refer to Appendix G, Aquatic Resources Assessment, for more detail.

5. Education

“In the end, we will conserve only what we love, we will love only what we understand, we will understand only what we are taught.”

—*Baba Dioum, Senegalese Conservationist*

“We have an opportunity to help people understand the remarkable amount of resources within the Santa Ana Watershed and the work that is being done to protect and enhance these resources.”

—*Martha Davis, Inland Empire Utilities Agency*

July 23, 2002

Environmental educational programs strive to provide proactive—rather than reactive—solutions to water quality and waste disposal problems. The ultimate goal of environmental educational programs is to provide information and a context for behavioral change. Educational messages must be powerful enough to inspire someone to break a habit such as over-fertilizing a lawn or taking 45-minute showers. The implementation of environmental education within the watershed may be accomplished through a combination of three strategies: public outreach, educational programs, and interpretive signage.

With respect to water resources, one of the most effective ways to reduce non-point source pollution is through public education. Throughout the watershed, point sources of water contamination have been reduced, and water quality improved, through use of better technology and through efforts of the regulators as well as the regulated community. Non-point sources of water contamination are areas discharges to soil, groundwater, and surface waters, such as inappropriate application of waste and fertilizers and atmospheric deposition of contaminants to the soil and water bodies.



While point sources can be traced back to a single source, such as the end of a pipe, non-point sources can rarely be traced back to individuals and will require regions behavioral changes to reduce contamination.

The importance of education is easy to overlook within the watershed, as no specific organization has jurisdiction over education, unlike trails, wetlands, and habitat projects. Beyond standard classroom curriculum, educational programs do not have specific agency oversight as mandated by law, although many water agencies do have water education programs in place. Educational programs are decentralized throughout the region, carried out by individual water agencies or nonprofit organizations. Whereas many groups are educating people about water conservation or habitat improvement within the watershed, few groups if any specifically educate about the Santa Ana Watershed. The watershed



Huell Howser, shown here with Joe Grindstaff, SAWPA General Manager, produced an educational video about the Santa Ana Watershed. Photo courtesy of SAWPA.

concept is not yet widely understood—many people are not sure what a watershed is, or which one they live in. Agencies, organizations, and individuals within the watershed recognize the need for additional educational opportunities within the Santa Ana Watershed.

Educational Program Types	Notable Santa Ana Watershed Examples
Nature centers and interpretive exhibits	Expansion of Santiago Oaks Regional Park's educational facilities to include a Watershed and Nature Education Center with high-tech innovative exhibits (in progress)
Tours	The Orange County Water District (OCWD) offers tours of the Prado Wetlands led by a naturalist. To sign up for a tour, go to http://www.ocwd.com/_html/tour.htm . Eastern Municipal Water District (EMWD) offers tours of the Hemet/San Jacinto Constructed Wetlands, and Elsinore Valley Municipal Water District (EVMWD) offers student tours.
Brochures/flyers	"The Good, the Bad, and the Invasive," Santa Ana Watershed Association of RCD's invasive plant educational brochure
Events/meetings	Annual Coastal Clean-up, held each September and hosted by a number of organizations including inland cleanups sponsored by Trails 4 All
Curriculum development	California Coastal Commission compilation of K-12 curriculum specific to Upper Newport Bay with hands-on restoration activities (in progress). EVMWD offers classroom presentations, books, and student/teacher workbooks. Riverside Corona RCD and OCWD are developing curriculum on invasive speices and the importance of wetlands. Western Municipal Water District (WMWD) offers the Water Conservation Garden Activity Book: a teacher's guide to activities and lesson plans relating to water conservation.
Homeowner guides and workshops	San Bernardino Municipal Water District's web site www.sbvmd.com , hosts "The Easy Guide To Lawn Watering--Save Water & Cost," including a table that explains the total number of minutes to water your lawn each week. EVMWD offers a landscape workshop series, homeowner water audits, and conservation booklets and materials. WMWD recently published a brochure titled "Guide to Landscape Water Conservation in western Riverside County." The Riverside Lands Conservancy offers a useful and informative booklet titled "Stream Care- Every Person's Guide to Healing Waterways."
Videos	Huell Howser's video on the Santa Ana Watershed, Elsinore Valley Municipal Water District (EVMWD) Videos, and SAWA Video, "Arundo's Fatal Grip" with Congressman Calvert (available for purchase for \$17.00)
Job training/scholarships	Orange County Conservation Corps- employs southern California youth to implement environmental projects, including recycling more than 1.6 million pounds of recyclable materials and completion of over 215 projects to maintain parks, beaches, rivers, and trails.
Internships	UC Irvine School of Social Ecology (http://www.seweb.uci.edu/) offers paid internships for university credit.

Table 3-4 Education Program Types and Examples



On Saturday, April 27, 2002, SAWPA and EIP Associates hosted a booth at the annual Environmental Expo at Cal State San Bernardino. The primary focus was to solicit input from Santa Ana Watershed residents and other stakeholders such as organizations and agencies involved with resource conservation or recreation. Two different surveys were produced for the event: a Household Survey, aimed at watershed residents, and an Organization and Agency Survey. SAWPA and EIP staff spent great deal of time educating watershed residents and stakeholders about watershed issues and the development of the Environment and Wetlands portion of the Santa Ana Integrated Watershed Plan

While not enough household surveys were completed to yield any statistically significant results, survey tabulation from the Expo and Santa Ana River Symposium did generate some interesting information. For example, completed surveys reflected the fact that many people do not know what a watershed is. The Expo attracted watershed residents that have at least some interest in and knowledge of environmental issues. Therefore, the sample population was biased in that they were more likely to know what a watershed is than a random population sampling. However, survey respondents reacted to the fill-in-the-blank question "What is a watershed?" in one of four ways. 32% of respondents answered the question incorrectly, 25% left the question blank, 14% answered with "I don't know" or similar expression, while only 29% of respondents answered the question correctly. It should also be noted the survey station (where most people filled out their survey) furnished a conspicuously posted watershed definition.

Recommendation #3: Engage the Community through Education and Recreation

- 3-A. Improve recreational opportunities for the region, including access to streams, lakes, and beaches through dedication of easements and land acquisition.
- 3-B. Increase water conservation and decrease imported water use through public education and provision of water saving devices.
- 3-C. Involve the public through outreach and education coordinated with the agencies and schools in the watershed.
- 3-D. Increase available open space throughout the region, including balancing open space availability among various communities by increasing parkland acreage in densely urbanized areas.



Santa Ana River Symposium, April 2002.

Photo courtesy of EIP.

A. Public Outreach

Many watershed residents do not understand that the storm drain system is completely separate from the sewer system in the watershed: there is no treatment system or filter between a storm drain on the street and the Pacific Ocean. Used motor oil or a cigarette butt thrown out of



a car window—be it in Corona, Big Bear, or Costa Mesa—will ultimately end up on the beach. Unclean stormwater runoff flowing into the Pacific Ocean causes swimmers and surfers to become sick and may result in beach closures. Public education will make clear the linkages between the condition of the watershed and the health and well-being of the population, wildlife, and ocean. Public service campaigns address nonpoint source pollution, as well as the reduction of trash, animal waste, organic matter, and other pollutants that wash into storm drains and then into the rivers and ocean. Public involvement programs should also encourage



Santa Ana River, April 2002
 Photo courtesy of EIP Associates

Program Name	Website
The California Regional Environmental Educational Center--Regions 9a and 10	www.creec.org
Global Learning and Observations to Benefit the Environment	www.globe.gov
The Global Rivers Environmental Education Network	www.earthforce.org/green/
The North American Association of Environmental Educators	www.naaee.org/
The US EPA's Water Office Kid's Page	www.epa.gov/kids/
Earth 911	www.earth911.org/usa/master.asp
Water Education for Teachers	www.projectwet.org/
Local resource conservation districts and local water districts, such as as the Santa Ana Watershed Association of Resource Conservation Districts and water districts such as EMWD, WMWD, IEUA, SBVMWD, OCWD, and EVMWD. WMWD funds the Water Education Advisory Council which brings together representatives from local water districts to collaborate on water education programs.	www.sawarcd.com , www.emwd.com , www.ieua.org , www.emwd.org , www.ocwd.com , www.wmwd.com , www.svvmwd.com

residents to become involved in the cleanup of the rivers and build upon existing programs, such as the use of volunteers in monitoring river water quality.

In addition to those issues most directly related to the condition of the watershed, outreach programs should also address broader environmental issues, including sustainability. At the simplest level, sustainability is the ability to meet current needs without compromising the ability of future generations to meet their own needs. This goal encompasses a range of concepts, such as recycling, energy and water conservation, use of appropriate building materials, minimizing use of hazardous materials, appropriate transportation planning, and the purchase of environmentally friendly products and packaging.

Furthermore, public outreach programs should strive to inform watershed residents of political awareness issues and ballot initiatives, such as park and water bonds that provide funding for habitat acquisition and restoration, trail planning, and water quality improvements. For example, the SAWPA quarterly newsletter provides information on upcoming bond issues and includes descriptions of projects funded with previous bond money.

B. Educational Programs

Educating children is equally important as continuing education for adults. Incorporating more environmental and water resource education into school curriculum, including as many field trips and hands-on programs as feasible, is the most effective way to ensure that



the watershed's next generation will be commendable environmental stewards. Education programs for children should be built upon the extensive network of existing resources such as those presented in Table 3-5.

Education programs for adults should include development of backyard habitat for wildlife, gardening techniques that minimize pesticide and herbicide use, natural methods of pest control, composting, organic gardening, planning and construction of stormwater drainage systems that promote groundwater infiltration, and low-water gardening and landscaping using improved irrigation and mulches. For example, Western Municipal Water District and Elsinore Valley Municipal Water District offer annual landscape workshops for homeowners, which include instruction in landscape design, drip irrigation, and sprinkler design. The Riverside-Corona RCD has contracted with the Riverside County Flood Control District since 1996 to provide Santa Ana Homeowner Garden Workshops, Adult Education Program.



Kerwin Russell of the Riverside-Corona Resource Conservation District is shown here leading a SAWA field trip.
Photo courtesy of EIP Associates.



Scoping Meeting Two, July 26, 2002
Photo courtesy of EIP Associates

The watershed is home to several higher education institutions, such as California State University, San Bernardino; University of California, Riverside; University of California, Irvine; California State University, Fullerton; University of Redlands; The Claremont Colleges; California State Polytechnic University, Pomona; and Loma Linda University. These institutions have opportunities to conduct research and teaching related to the condition of the watershed. Given the interrelationships between the physical and natural environment, this includes a variety of fields, including hydrology, biology, environmental planning, ecology, urban planning, architecture, civil engineering, transportation planning, atmospheric sciences, geography, education, sociology, chemical engineering, and public health.

For example, Cal State San Bernardino is home to the Water Resources Institute (WRI). WRI offers a number of services for the watershed. These comprise public conference and speakers series, such as the annual "Sharing the Waters" conference held each fall; a water resources archive that includes Inland Empire well data dating back over 80 years, aerial photos dating to the 1930s, maps, USGS and other government publications dating back nearly 100 years, and oral histories; a website that houses large



amounts of water-related data and fun facts about water (<http://wri.csusb.edu/>); and dispute resolution services for water and other public agencies. Educational resources available through WRI consist of water-related research on technical or public policy issues; academic programs, including a BS degree in Environmental Geology and an Master's Degree of Public Administration with a Water Resources Management Specialization; and K-12 curriculum development related to water resources, the environment, and conservation. In addition, the University hosts an annual Inland Empire Environmental Expo each spring, with attendance upwards of 10,000 people.

Eastern Municipal Water District (EMWD), Elsinore Valley Municipal Water District (EVMWD), Riverside-Corona Resource Conservation District, and Western Municipal Water District (WMWD) have designed the "Teaching Southern California's Water Story" course through Fresno Pacific University and Cal State San Bernardino's College of Extended Learning. The fast-paced, independent study course allows students to earn professional credit while exploring several Southern California water sites. The course was designed to assist teachers in enhancing their water lessons and ties into the History and Social Science Frameworks for California public schools.

WMWD also offers a number of regional programs via the Water Education Advisory Council. The Council, funded by WMWD, provides

- Theater program performances;
- Science fair contests;
- Mini-grant program for teachers implementing new and innovative water education programs;

- H₂O Explorer Badge program; and
- Book/materials distribution.

Through the Water Education Advisory Council, EVMWD offers Project Wet, a groundwater model demonstration program that teaches students about the use of groundwater as a resource, the water cycle, and the water cycle's role in groundwater replenishment. The program also highlights hydrogeology, nonpoint source pollution, identification of the water table, watershed protection, and water recycling. Grades 4 through 6 are targeted; however, the lesson can be tailored for both lower and higher grade levels. EVMWD has been using the groundwater model for classroom presentations for ten years.



Storm drain stencils are an excellent example of public outreach through signage. The Riverside Corona RCD has stencilled over 1,336 storm drains since 1996 with a similar message. *Photo courtesy of Heal the Bay*

EMWD's Education Program is a free resource for teachers and students in over 100 schools within the watershed. The mission of EMWD's Education Program is to foster understanding of water and wastewater issues and to promote wise water use among the future leaders of the Santa Ana Watershed community. They go about fulfilling this mission through a facilities tour program (1,624 student reached in 2001/02 school year); water awareness theater assemblies (27,939 students reached); classroom presentations (2,051 students reached); water education materials (19,454 students reached);



career days (13,375 students reached); science fair assistance (67 students reached); a water awareness poster contest (3,300 students participated in 2001/02); and teacher in-services (1,035 students reached). In the 2001/02 school year, 68,845 students were reached with a water and/or wastewater message.

EMWD also offers an extensive hands-on wetlands education program to school groups and other community groups at its Hemet/San Jacinto Multipurpose Constructed Wetlands. A professional groundwater model is a tool that is taken to classrooms for presentations and is also demonstrated with each group touring EMWD's Wetland Water Education Facility. Watershed and groundwater issues are key components of EMWD's overall education program.



Dan Bogan of the Riverside County Park and Open Space District explaining the massive root structure of *Arundo donax*
Photo courtesy of EIP Associates.

Western Municipal Water District offers several excellent programs to educate watershed residents and students about water conservation and landscaping. WMWD's "Landscapes Southern California Stylesm" program is a water conservation demonstration garden, an interpretive project that includes over 250 species of water-wise plants on one acre. The garden

receives over 10,000 visitors each year and seminars are conducted for the general public addressing such topics as appropriate plant selection, efficient irrigation methods, and natural pest control. In addition, WMWD provides about 50 different free brochures on water to the public. WMWD has also been a leader in the field of water education support for area schools since 1982, offering free materials including student workbooks, teachers' guides, videos, speakers, field trips, theater programs, grants for teachers, scholarships for students studying water related curriculum, and book donations to school libraries.

C. Interpretive Opportunities

When people visit open space, parks, community gardens, historic sites, cultural resources, riverfront walks, bike paths, wetlands, or habitat preserves, opportunities to learn about what they see and experience should be available. This requires interpretive programs that translate information for a variety of audiences. The information presented could be scientific, environmental, cultural, or even artistic in nature. Within the watershed, interpretive programs include hands-on programs at nature centers and museums, docent-led nature walks, summer day-camps for families, tours of water resources or flood management facilities, bird-watching or wildlife viewing events, living history exhibits at cultural sites, or signage and informational materials at accessible locations in parks, along trails, or at wetlands or habitat preserves.

The Metropolitan Water District (MWD) offers extensive educational programs throughout Southern California. MWD's Diamond Valley Lake has a museum and offers tours and field trips to the Santa Rosa Nature Preserve in Murrieta.



Orange County River Park
 Photo courtesy of The Newport Beach Chapter Surfrider Foundation

Further interpretive opportunities include the Watershed and Waterway Signage Program, in which the Santa Ana Watershed Project Authority and its member agencies would work with Caltrans to implement a signage program for the watershed.

For example, watershed signage would include signs saying, “You are entering the Santa Ana Watershed” at, among others, the following locations:

- I-5 near La Mirada
- I-5 in unincorporated Orange County
- I-10 in Pomona
- I-10 in Beaumont
- I-15 near Lake Elsinore
- I-215 in northern San Bernardino County
- SR-71 near Pomona
- SR-91 near Cypress
- SR-60 near Pomona
- SR-55 near Newport Beach
- SR-57 near Brea

In addition, roads and highways over waterways should have signs indicating the waterway crossed (e.g., Santa Ana River, Santiago Creek). These locations would include, among others, the following:

- SR-91, I-405, I-15, SR-60, I-10, I-215, and I-5 as they cross the Santa Ana River
- I-15 as it crosses Lytle Creek
- I-215 as it crosses the San Jacinto River
- SR-71 as it passes along the Prado Wetlands

The Watershed and Waterway Signage Program would enlighten Santa Ana Watershed residents as to which watershed they reside in and familiarize them with the names of local waterways. With the help of Caltrans and the California Resources Agency, this program could be implemented Statewide to create a network of watershed signage. California residents and visitors would not only grasp the concept that “wherever you are, you’re in a watershed,” but would become familiar with the names of the watersheds they live in and travel through, thus creating these important connections to the land and water.

5. Partnerships

Recommendation #4: Plan for the Future

- 4-A. Facilitate partnerships among groups with similar goals and support community based sub-watershed groups.
- 4-B. Work with the State Resources Agency through the California Watershed Management Forums and other standard Regional Agencies to achieve State and regional goals.



- 4-C. Use the best scientific data available and regional collaboration to make complex resource management decisions.
- 4-D. Promote effective watershed monitoring, data management, and project evaluation programs.
- 4-E. Identify and pursue future sources of funding to complete watershed projects. Funding source identification should include provisions for operation and maintenance of projects in addition to capital expenditures.
- 4-F. Utilize this Santa Ana Integrated Watershed Plan, Environmental and Wetlands Component as a living document, including regular updates to maintain current watershed-wide planning and coordination.

Why Partner?

Communication is an essential element within any watershed, especially among groups with the authority to manage natural resources. As watershed planning has catapulted to an issue of international significance throughout the past few decades, awareness of watershed ecology and hydrology has illuminated the need for managers within each watershed to work together to manage resources. Watersheds are made up of multiple interests; no one group or individual can manage all of a watershed’s resources by themselves. Watershed partnering means bringing together different combinations of citizen groups at difference scales and helping them to work together to value and enhance the resources within the watersheds.

Due to its large size, the Santa Ana Watershed provides the opportunity to coordinate the management of 1.7 million acres within one

Team Arundo

- Riverside County Parks and Open Space District
- Orange County Public Facilities and Resources Department
- Santa Ana Watershed Project Authority (SAWPA)
- Santa Ana Watershed Association of Resource Conservation Districts (SAWA)
 - Riverside-Corona Resource Conservation District
 - Inland Empire West Resource Conservation District
 - East Valley Resource Conservation District
 - San Jacinto Basin Resource Conservation District
 - Elsinore-Murrieta Resource Conservation District
- Riverside County Flood Control and Water Conservation District
- Orange County Water District
- California Conservation Corps
- Orange County Conservation Corps
- California Exotic Pest Plant Council
- Monsanto Corporation

ecological unit. Assembling seemingly conflicting interests at same table to resolve issues of concern has proven very successful within the Santa Ana Watershed, and has resulted in unique and effective partnerships. The large scale of Santa Ana Watershed is both a challenge and a significant opportunity. There are many groups to bring together, but when everyone is working together, there is a much greater ability to achieve landscape-level resource management goals. Whereas watershed planning may be easier within smaller watersheds, the difficulty of



Santa Ana River Trail Partners	
<p>Counties: Riverside Orange San Bernardino</p> <p>Cities: Colton Highland Loma Linda Redlands Riverside Anaheim Orange Santa Ana Villa Park Corona Huntington Beach Norco Rialto San Bernardino</p>	<p>Agencies: Orange County Water District U.S. Forest Service, San Bernardino National Forest Santa Ana Watershed Project Authority</p> <p>Organizations: Orange County Equestrian Coalition Loma Linda University Community Outreach U.S. Army Corps of Engineers California Department of Parks and Recreation Trails 4 All San Bernardino Riders Mike Carona Foundation National Park Service, Rivers and Trails Conservation Assistance Orange County Sheriff's Office</p> <p>Consultant Groups: Dangermond Group EDAW Withers and Sandgren</p>

planning within larger watersheds is balanced by the ability to affect large-scale regional resource management and the opportunity to pool resources on a regional scale.

Examples of Notable Partnerships within the Watershed

The Santa Ana River Watershed Group (SARWG)

SARWG is a collaborative effort of public and private sector agencies and interests focused on water quality management concerns in the Santa Ana River Watershed area. Principal Conveners include San Bernardino, Riverside and Orange Counties, the Santa Ana Watershed Project Authority and the Orange County Sanitation District. Among the members are dairy owners, environmental representatives, the major

counties spanning the watershed area (Riverside, San Bernardino and Orange), and other stakeholders—nearly 50 groups in all. A tri-county memorandum of understanding has enabled SARWG to discuss and think about regional issues together with so many diverse stakeholder groups.

Orange Coast River Park Partners
<ul style="list-style-type: none"> ■ Friends of Harbors, Beaches, and Parks ■ City of Costa Mesa ■ City of Huntington Beach ■ City of Newport Beach ■ City of Laguna Beach ■ County of Orange ■ California Coastal Conservancy ■ Surfrider Foundation, Newport Beach Chapter ■ California Department of Fish and Game ■ U.S. Army Corps of Engineers ■ U.S. Fish and Wildlife Service ■ Huntington Beach Wetlands Conservancy ■ The Irvine Company

Team Arundo

Operating within the Santa Ana Watershed, Team *Arundo* is recognized throughout the State of California as a leader in *Arundo* removal efforts. Team *Arundo* members have undertaken a number of ambitious invasive species removal and restoration projects throughout the watershed. In addition to the partners listed below, the Nature Conservancy was historically a part of Team *Arundo*. The foresight and leadership of these groups have proven instrumental in elevating the need for *Arundo* removal to an issue of statewide importance.



Santa Ana River Trail

The Santa Ana River Trail is discussed at length in Sections 2C and 3A-3, and the following provides a list of major partners in the trail effort, many of whom have been involved for three or four decades.

Chino Basin Partners

- Inland Empire Utilities Agency
- Santa Ana River Watershed Group (SARWG)
- Milk Producer’s Council
- Synagro
- Orange County Water District
- Chino Basin Watermaster
- All of the Chino Basin Cities
- Santa Ana Watershed Project Authority
- U.S. Department of Agriculture/Natural Resources Conservation Service
- U.S. Department of Energy and the California Energy Commission
- Santa Ana Watershed Association of Resource Conservation Districts
- San Bernardino County
- Orange County Flood Control
- Orange County Sanitation District

Orange Coast River Park

With a paid membership of over 500 persons and organizations, the Friends of Harbors, Beaches, and Parks was established to promote the protection, enhancement, and expansion of Orange County regional parks, open space preserves, recreational trails, and coastal recreational facilities. Shortly after establishment in 1997 the group set its highest priority project

as the Orange Coast River Park, which would create a 1,400-acre park at the mouth of the Santa Ana River. This park would be “assembled from a patchwork quilt of neighboring lands owned and individually managed by three cities; the County of Orange; several regional, State, and federal agencies; and private entities” (Orange Coast River Park Proposal 2001).

Chino Basin Program

Chino Basin is one of the largest groundwater basins in southern California, and is faced with significant organics management and water quality challenges. Through the collaboration of community leaders including the Milk Producers Council, Inland Empire Utilities Agency, Chino Basin Watermaster and many others, the Basin has developed an award winning organics management and groundwater protection strategy that offers an

Santa Ana Sucker Discussion Group

SUPPORTING PARTICIPANTS:

- City of Riverside
- City of San Bernardino
- County of Orange PFRD
- Orange County Sanitation District
- Orange County Water District
- Riverside County Flood Control and Water Conservation District
- San Bernardino County Flood Control District
- SAWPA

OTHER PARTICIPANTS:

- U.S. Fish and Wildlife Service
- California Department of Fish and Game
- Santa Ana Regional Water Quality Control Board
- Riverside-Corona RCD
- City of Corona



integrated (multiple benefit) watershed plan for treating, recycling and reusing organic materials. This strategy will deliver significant water and air quality improvements for the region, enhance the reliability of local water supplies, generate clean renewable energy and recycled organic materials, provide significant local economic benefits and contribute to enhanced wildlife habitats within the Chino Basin. Innovative projects under construction include state-of-the-art anaerobic digesters and composting facilities, as well as California’s first platinum “LEED” rated water and energy efficient office building that will serve as the new headquarters for the Inland Empire Utilities Agency.

Santa Ana Sucker Discussion Group

The Santa Ana Sucker Discussion group, which meets regularly at SAWPA headquarters, has recently completed a draft Conservation Program for the federally threatened fish. The program, which has been submitted to the U.S. Fish and Wildlife Service, enumerates activities that may be undertaken by organizations within the Watershed to minimize effects on the sucker. Conservation Program partners (which do not include all discussion group members) contribute financially to the program on an annual basis, which helps support much needed research and conservation measures for the sucker.

Lake Elsinore and San Jacinto Watersheds Authority (LESJWA)

The joint powers agency referred to is the Lake Elsinore and San Jacinto Watersheds Authority (LESJWA), which was created under a Joint Powers Agreement on March 8, 2000. A water resource improvement program has been established for the 700-square-mile San Jacinto and Lake Elsinore watersheds. These improvements address the following objectives:

- Provide nonpoint pollution control
- Develop flood control projects
- Protect wildlife habitat
- Protect and enhance recreational resources

LESJWA meets monthly and is governed by a Board of Directors comprised of one representative from each of the member agencies. The Board is also supported by a Technical Advisory Committee and a Public Relations Committee, which meets regularly.

LESJWA has entered into agreements with the Regional Water Quality Control Board for the purpose of conducting nutrient, pathogen, and toxic TMDL monitoring programs. Studies included are a Canyon Lake Pathogen TMDL and Internal Loading and Nutrient Cycling in Lake Elsinore. A TMDL Workgroup currently meets on a monthly basis to enlist the participation of stakeholders in solving the various TMDL issues.

LESJWA Partners
City of Canyon Lake
Elsinore Valley Municipal Water District
City of Lake Elsinore
County of Riverside
Santa Ana Watershed Project Authority

San Jacinto River Watershed Council

The Council is a multi-agency non profit collaborative group of watershed stakeholders. Their purpose is “to ensure that the current and potential uses of the San Jacinto River Watershed’s resources are sustained, restored, and where possible, enhanced, while promoting the long-term social and economic vitality of the



region. The council will be serving in an advisory role in the development of the San Jacinto Watershed Management Plan.

Southern California Wetlands Recovery Project

The Southern California Wetlands Recovery Project is a partnership of public agencies working cooperatively to acquire, restore, and enhance coastal wetlands and watersheds between Point Conception and the international border with Mexico. Using a non-regulatory approach and an ecosystem perspective, the Wetlands Project will work together to identify wetland acquisition and restoration priorities, prepare plans for these priority sites, pool funds to undertake these projects, implement priority plans, and oversee post-project maintenance and monitoring. The goal of the Southern California Wetlands Recovery Project is to accelerate the pace, the extent, and the effectiveness of coastal wetland restoration in Southern California through developing and implementing a regional prioritization plan for the acquisition, restoration, and enhancement of Southern California's coastal wetlands and watersheds. Ultimately, the Wetlands Project's efforts will result in a long-term increase in the quantity and quality of the region's wetlands.

Implementation

1. The Santa Ana Watershed community should continue to create new partnerships and projects that improve the ecological health of the natural systems of the Watershed. SAWPA and other interested agencies, organizations, and individuals could help facilitate this process.
2. SAWPA should continue to facilitate Watershed discussions to educate and inform Watershed leaders in the community about funding opportunities

and partnerships that would be beneficial to initiating and completing projects identified through this Plan and beyond.

3. SAWPA should continue to work with the counties and appropriate cities to expand Watershed cooperation.
4. County and city planners should participate in Watershed project discussions so that the process of implementing the projects identified in this Plan is carried forward.
5. SAWPA should continue to develop and sponsor watershed and subwatershed groups and task forces.
6. Watershed participants should invest resources to ensure that watershed interests such as connectivity, trails, open space, biological diversity, water quality and supply, wetlands, are supported and included in the County of San Bernardino General Plan Update.
7. As projects are proposed through collaborative funding opportunities, watershed partners should utilize the MSHCP in making decisions regarding land acquisition areas within Riverside County.
8. Watershed stakeholders should continue to engage in watershed-wide (interjurisdictional) collaboration regarding connectivity, trails, and other watershed needs so that landscape linkages, public/private partnerships, acquisition, in-holdings, and public coastal access goals are realized in the County of Orange General Plan Update and related planning efforts.

7. Funding

Watershed participants agree that one of the greatest obstacles to implementing good projects in the region is the lack of funding. While



Potential Watershed Project Funding Sources												
Funding Program	Resource Evaluation	Restoration/Conservation	Water Resources/Water Quality	Habitat/Wetland	Wetland	Wetland/Estuaries	Fisheries	Economic Development/Redevelopment	Recreation	Pollution Control	Wetland Control	Eligible Entities
Bring Back the Nations Grant Program												Local governments, states, and local nonprofit organizations
Brownfields Assessment Demonstration Pilots												States (U.S. territories), political subdivisions (including cities, towns, counties), and federally recognized Indian tribes
Brownfields Cleanup/Revolving Loan Fund Pilots												Entities must have been awarded a brownfields assessment demonstration pilot, or be a political subdivision with jurisdiction over sites that have either (1) been the subject of a targeted brownfields site assessment or (2) been selected to be the subject of an EPA assessment.
Brownfields Job Training and Development Demonstration Pilots												Colleges, universities, nonprofits, training centers, community-based job training organizations, states, cities, towns, counties, U.S. territories and federally recognized Indian tribes.
California Riparian Habitat Conservation Program												Resource Conservation Districts; federal, state, and local governments; nonprofit organizations; other special districts
California Wetland Habitat Program												Private landowners
Capitalization Grants for Clean Water State Revolving Funds												States and Puerto Rico
Capitalization Grants for Drinking Water State Revolving Fund												States and Puerto Rico
Clean Vessel Act Grant Program												All states, as well as Puerto Rico, the Virgin Islands, Guam, the Commonwealth of the Northern Mariana Islands, American Samoa, and Washington, DC
Coastal Nonpoint Source Program												Municipalities, local agencies, educational institutions, nonprofit organizations
Coastal Program												Projects on either public or private land in coastal watersheds
Coastal Resources Grant Program												Coastal counties and cities with approved local coastal programs
Coastal Services Center Cooperative Agreements												State and local governments, public nonprofit institutions/organizations, other public institutions/organizations
Coastal Wetlands Planning, Protection and Restoration Act Program												All states bordering on the Atlantic, Gulf (except Louisiana), and Pacific coasts and the Great Lakes
Coastal Zone Management Administration/Implementation Awards												Coastal states, including Great Lakes states, Puerto Rico, Virgin Islands, Guam, American Samoa, the Trust territories of the Pacific, and the Commonwealth of the Northern Mariana Islands
Community-Based Restoration Program												State, territorial, local, or tribal governments; regional governmental bodies; public or private agencies or organizations; universities and colleges; private profit and nonprofit organizations
Conservation Reserve Program												Individuals, partnerships, associations, Indian tribal venture corporations, estates, trusts, other business enterprises or legal entities, a state, state political subdivisions, state or local agencies owning or operating land might be eligible to participate
Cooperative Forestry Assistance Programs												Owners of non-federal lands; rural communities; urban/municipal governments; nonprofit organizations; and state, local, and private agencies acting through State Foresters or equivalent
Environmental Education Grants Program												Local, tribal, or state education agencies, colleges and universities, nonprofit organizations, state environmental agencies, and noncommercial education broadcasting agencies
Environmental Quality Incentives Program												Non-federal landowners (including American Indian tribes) engaged in livestock operations or agricultural production
Fisheries Development and Utilization Research and Development Grants and Cooperative Agreements Program												Any U.S. citizen or national, corporations, partnerships, associations, Indian tribes, state and local governments, and other non-federal entities.
Fisheries Restoration Grants Program												State and local agencies, non-profit organizations, and individuals
Five-Star Restoration Program												Any public or private entity that engages in community-based restoration
Flood Mitigation Assistance Program												State agencies, participating NFIP communities, or qualified local organizations
Flood Protection Corridor Program												Public agencies, nonprofit organizations, Department of Water Resources
Forestry Incentives Program												Individuals, groups, Indian tribes or other native groups, associations, and corporations whose stocks are not publicly traded
Groundwater Recharge Feasibility Study Grants												Public agencies and incorporated municipal water companies
Habitat Conservation Fund												Local agencies, including counties, cities, or special management districts
Inland Wetland Conservation Program												Private Landowners

Table 3-6 Potential Watershed Project Funding Sources



Potential Watershed Project Funding Sources										
Program	Research/Education	Restoration/Conservation	Water Resource/Inflow Quality	Wildlife/Habitat	Wetland	Wetland Ecosystems	Wetlands	Economic Development/Redevelopment	Recreation	Watershed Protection
Land and Water Conservation Fund Grants to States										States, American Samoa, U.S. Virgin Islands, Puerto Rico, Guam, Northern Mariana Islands and the District of Columbia
National Coastal Wetlands Conservation Grant Program										Designated state, territorial or commonwealth resource agencies of coastal states, including states that border the Atlantic or Pacific Oceans, the Gulf of Mexico, and the Great Lakes.
National Estuary Program										State, interstate, and regional water pollution control agencies and entities; state coastal zone management agencies; interstate agencies; other public/private nonprofit organizations and institutions; and individuals are eligible.
National Sea Grant College Program										State and local governments, nonprofit and for-profit organizations, academic organizations, federally recognized Indian tribes, and individuals
Nonpoint Source Implementation Grants (319 Programs)										Farmada grants are awarded to a lead agency in each state and territory.
Nonpoint Source Program										Local agencies, nonprofit organizations formed by landowners to prepare and implement local nonpoint source plans
North American Wetlands Conservation Act Grants										Public or private, profit or nonprofit entities or individuals establishing public-private sector partnerships
Partners for Fish and Wildlife Program										Private landowners
Permanent Wetland Easement Program										Private Landowners
Pesticide Environmental Stewardship Grants										Open only to PESP Partners and Supporters
Public Works and Development Facilities Program										States, political subdivisions of a state, Indian tribes, special-purpose state/local government units, or public or private nonprofit organizations
Riparian Riverine Habitats Program										City, county, district, local agencies formed for park purposes, other districts, and federally recognized California Indian tribes
Science to Achieve Results										U.S. states, territories, and possessions, including the District of Columbia, public and private universities and colleges, hospitals, laboratories, state and local government departments, other public or private nonprofit institutions, and individuals who have demonstrated unusually high scientific ability.
Southern California Wetlands Recovery Project										Public or private groups
Sustainable Agriculture Research and Education										Lead-grant colleges or universities, other universities, state agricultural experiment stations, State cooperative extension services, nonprofit organizations, individuals with demonstrable expertise, and federal or state governmental entities
Sustainable Development Challenge Grants										Nonprofit organizations and community groups, federally recognized Indian tribes, state and local governments
Urban Stream Restoration Program										Local agencies, nonprofit organizations, local community conservation corps
Water Conservation Feasibility Study Grants										Public agencies and incorporated mutual water companies
Water Quality Cooperative Agreements										State water pollution control agencies, interstate agencies, local public agencies, Indian tribes, nonprofit institutions, organizations, and individuals
Water Quality Planning Grant Program										Local agencies, special districts
Water Quality Special Research Grants Program										State/local governments and academic/nonprofit institutions located in the United States are eligible for EPA, National Science Foundation, and USDA funding. Profit-making firms and federal agencies are eligible for USDA funding.
Water Recycling Program										Local municipalities
Watershed Assistance Grants										Nonprofits, tribes, and local governments.
Watershed Protection and Flood Prevention Program										Local or state agency, county, municipality, town or township, soil and water conservation district, flood prevention/flood control district, Indian tribe or tribal organization
Watershed Protection Programs										Municipalities, local agencies, nonprofit organizations
Wetlands Program Development Grants										States, Local Governments, Indian Tribes
Wetlands Reserve Program										individual, partnership, association, corporation, estate, trust, business, or other legal entity, a state (when applicable) a political subdivision of a state, or any agency thereof owning private land
Wildlife Conservation and Appreciation Program										State fish and wildlife agencies are eligible for funding. Private organizations and individuals must work with their state agency
Wildlife Habitat Incentives Program										Private landowners

Table 3-6 Potential Watershed Project Funding Sources



significant seed money and partnerships are currently in place for a number of watershed projects such as the Santa Ana River Trail completion, there are many more projects, both large and small, which require funding. This document highlights many of the projects that would result in improvements within the Watershed. It also identifies funding needs for these projects. If funding can be secured for these projects through increased awareness of the needs of this community, then the fundamental goal of this watershed plan will have been accomplished.

In an effort to facilitate greater understanding of potential funding sources available to project proponents, Table 3-6 was compiled. This table was derived from the U.S. Environmental Protection Agency, Catalog of Federal Funding Sources for Watershed Protection, Second Edition, and from the Los Angeles Regional Water Quality Control Boards website, Summary Document on Grant Funding Sources. For expanded information on the programs in Table 3-6, please refer to Appendix J. The table identifies different areas of interest or topics of program funding. These include: Research/Education; Restoration/Conservation; Water Resource/Water Quality; Wildlife/Habitat; Watershed; Wetlands/Estuaries; Fisheries; Economic Development/ Redevelopment; Recreation; Pollution control; Flood control. The column labeled “Eligible entities” describes the types of organizations or individuals eligible for the program.

8. Monitoring and Assessment

Outcome indicators are a useful way to measure change within an area. In this case, outcome indicators are used as part of the Santa Ana Integrated Watershed Plan, Environmental and Wetlands Component plan to measure changes

in the Santa Ana Watershed as a result of the efforts of SAWPA, SAWPA’s member agencies, other governmental agencies, and citizens’ groups. These changes can be the result of projects identified within the plan and other opportunities implemented throughout the watershed. The first step in categorizing outcome indicators is to distinguish indicators of outcome from those that measure the quantity of work activity done. The number of publicity flyers distributed or the number of water quality readings taken is an indicator of work activity. The knowledge levels of those targeted by the publicity flyers and the nitrogen levels determined from the water quality readings are indicators of outcome. It is extremely important to distinguish between different types of indicators in order to set a realistic, achievable timeframe to reach benchmarks. The U.S. Environmental Protection Agency describes four categories of outcome indicators. These are presented in Table 3-7.

To illustrate, distributing flyers to educate homeowners on fertilizer application is a work activity. The percentage of homeowners that reduced their fertilizer application after flyer distribution is a first order outcome indicator. The second order outcome indicator is the amount of fertilizer running off of private homes (a hard indicator to measure). Improvements in water quality in a neighborhood pond from reduced fertilizer load, such as lowered nitrogen levels, are a third-order outcome. Finally, improvement in the health of fish that are no longer threatened by eutrophication is a fourth-order outcome.

Benchmarks

Quantitative goals should accompany outcome indicators; however, some goals for improvement will take many years to reach, or



Table 3-7. Measurable Goals and Indicators

Outcome Indicator	Measures?	How Measured?	Examples	Comments
First-Order Outcome Indicators	Behavioral changes by households, businesses, and governments	Baseline data is determined by surveys.	Homeowner applying less fertilizer to yard	Measuring these outcomes will be a major way to track progress in implementing the watershed plan.
Second-Order Outcome Indicators	Reductions in pollutant discharges within the watershed	"End of pipe"	Reduction in fertilizer runoff from homes	Second-order indicators are difficult to measure.
Third-Order Outcome Indicators	Changes in water quality	Water quality monitoring	Reduction in nitrates of local pond downstream from home	Pollutant discharge reduction should cause increases in water quality, such as lowered nitrogen levels.
Fourth-Order Outcome Indicators	Changes to living resources	Population monitoring, human health surveys, toxicology studies in fish	Improvements in the health of local pond wildlife; AND extent to which the pond can support human uses such as fishing or swimming	These are long term indicators and may be based on many factors.

may never be reached due to unforeseen impediments. Therefore, it is important to celebrate successes by setting benchmarks, such as the attainment of 50 percent of the goals. Reaching both overall goals and benchmark goals provides opportunities for additional publicity to the Santa Ana Watershed efforts and recognizes the amount of hard work performed.

Santa Ana Watershed Data Management System (SAWDMS)

The Santa Ana Watershed Data Management System (SAWDMS) will be available for stakeholders to use for a variety of purposes. This watershed-wide database management system would include standardization of data from numerous stakeholders in the watershed, would enable Internet access to the data by appropriate entities, and would be used as a tool to improve water quality in the watershed.

The data collected would integrate surface and groundwater data to assist numerous water quality and water management programs.

Arundo Removal

With respect to the above classification of measurable goals, it is not feasible at this time to develop a monitoring matrix for all elements of the Santa Ana Integrated Watershed Plan, Environmental and Wetlands Component. However, the classification of measurable goals for the removal of *Arundo donax* would be as shown in Table 3-8.

Examples of Measurable Goals and Indicators

The following are examples of further types of measurable goals and indicators that would be identified after completion Environmental and Wetlands Component of the Santa Ana Integrated Watershed Plan:

1. Protect and Restore Habitat Resources

Remove Invasive Exotic Species

- Acres of land from which exotics have been removed



Table 3-8. Examples of Outcome Indicators for <i>Arundo</i> Removal	
Outcome Indicator	Example
First-Order Outcome Indicators	Number of acres of <i>Arundo</i> cut
Second-Order Outcome Indicators	Reduction in amount of water consumed by <i>Arundo</i>
Third-Order Outcome Indicators	Improvements in water quality and increases in water quantity
Fourth-Order Outcome Indicators	Recovery of least Bell's vireo population, as measured by number of breeding pairs

- Percentage of this land that has remained invasive-free after 5 years, 10 years, etc.
- Amount of new riparian habitat created

2. Improve Water Quality and Avoid Future Reductions to Ecosystem Function

Improve Water Quality

- Number of impaired water bodies within watershed (waterbodies removed from the State Water Resources Control Board’s 303(d) List of Impaired Waterbodies)
- Use of water quality indicators such as dissolved oxygen, salinity, turbidity, and temperature.
- Percentage of groundwater basins that meets drinking water standards

Increase water conservation/Decrease imported water use/Reduce salinity

- Watershed wide use of recycled water (measured by millions of gallons per day)
- Per capita daily water use (measured by gallons per day)
- Amount of water imported to the Watershed (measured by acre-feet per year)
- Use of local water sources and storage of local water (measured by acre-feet per year)
- Water “banked” in groundwater basins (measured by acre-feet per year)
- Reduction and elimination of sources of salt in the Watershed

3. Engage the Community through Education and Recreational Opportunities

Improve Outdoor Recreational Opportunities

- Miles of biking and hiking trails within the Watershed
- Number of mega-connected trails (e.g. over 5 miles long)
- Number of publicly provided camping sites
- Number of equestrian staging areas

Increase Open Space

- Acres of land under protection on various levels within the watershed (e.g., private, city, county, state, and conservation easements)
- Acres of land covered in permeable vs. nonpermeable surfaces
- Public space acreage per 1,000 people (from SCAG data)
- Acreage of open space that provide multi-purpose benefits

Promote Watershed Education / Community Outreach

- Percentage of watershed residents that can accurately answer the questions, “What is a watershed?” and “What watershed do you live in?”
- Incorporation of water conservation curriculum into Orange County, Riverside County, and San Bernardino County Schools



- Participation of watershed residents in annual Coastal Clean-up (sponsored by the Center for Marine Conservation)

4. Plan for the Future

Identify Future Sources of Funding

- Number of grant applications made for watershed projects from
 - a. Local funding sources
 - b. State funding sources
 - c. Federal funding sources
- Number of grants won for watershed projects from
 - a. Local funding sources
 - b. State funding sources
 - c. Federal funding sources
- Operational and maintenance funding budgeted (measured per millions of dollars invested)
- Number of broad programmatic funding sources identified

Santa Ana River Watershed Citizens Monitoring Project

The Santa Ana River Watershed Citizens Monitoring Program is funded through the U.S.EPA and the SWRCB, and administered through the Santa Ana RWQCB. The program is run by the Orange County Coastkeeper, with assistance from the Riverside Corona RCD and the East Valley RCD. Watershed citizens engage in monitoring activities to identify sources of nonpoint source contaminants. Public outreach and education is an integral part of the project, which trains volunteers to collect water quality data that is later reported to the RWQCB.

B. Opportunities

Watershed Projects

The following projects, shown in Table 3-9, have been proposed by watershed stakeholders including cities, counties, agencies, organizations, and individuals. These are projects that may be in need of partnering or funding. While some projects are further along than others, all of these projects would enhance the ecological function of systems within the Watershed. Types of projects include wetlands, education, trails, habitat, and invasive species removal. Many of these are multi-objective conservation projects serving two or more ecological purposes. Refer to Figure 3-5, for a map of potential wetland projects and Figure 3-6 for a map of other projects and opportunities within the Watershed. In Figure 3-6, the map legend identifies project categories. In addition, Appendix A, Scoping Meeting Notes and Appendix B, Watershed Project Database and Summary include more detail on projects if this information was available at the release of the Plan.

“Self-maintaining systems have certain attributes of a size, amount and shape to respond to forces of change, and to persist. At least four critical functions must be maintained and be able to support wildlife despite disturbance if the ecosystem is to be self-supporting. The health of a stream and its ability to withstand disturbance can be assessed by (1) habitat amount, (2) conduit of necessary elements, (3) connectivity between patches of habitat, and (4) transition between edges of habitats.”

—Jim Steele, EIP Associates

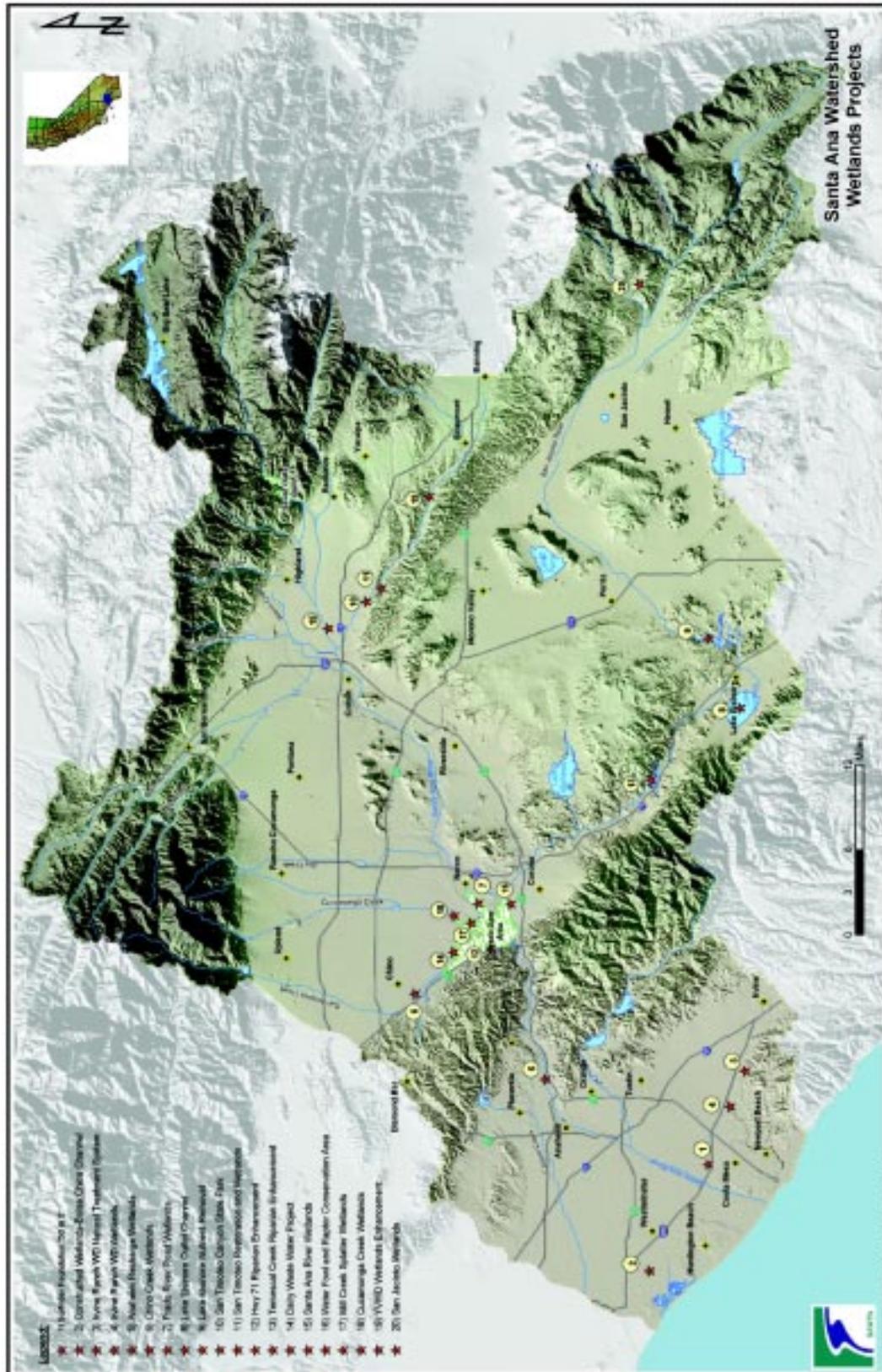


Figure 3-5 Potential Wetland Projects within the Watershed

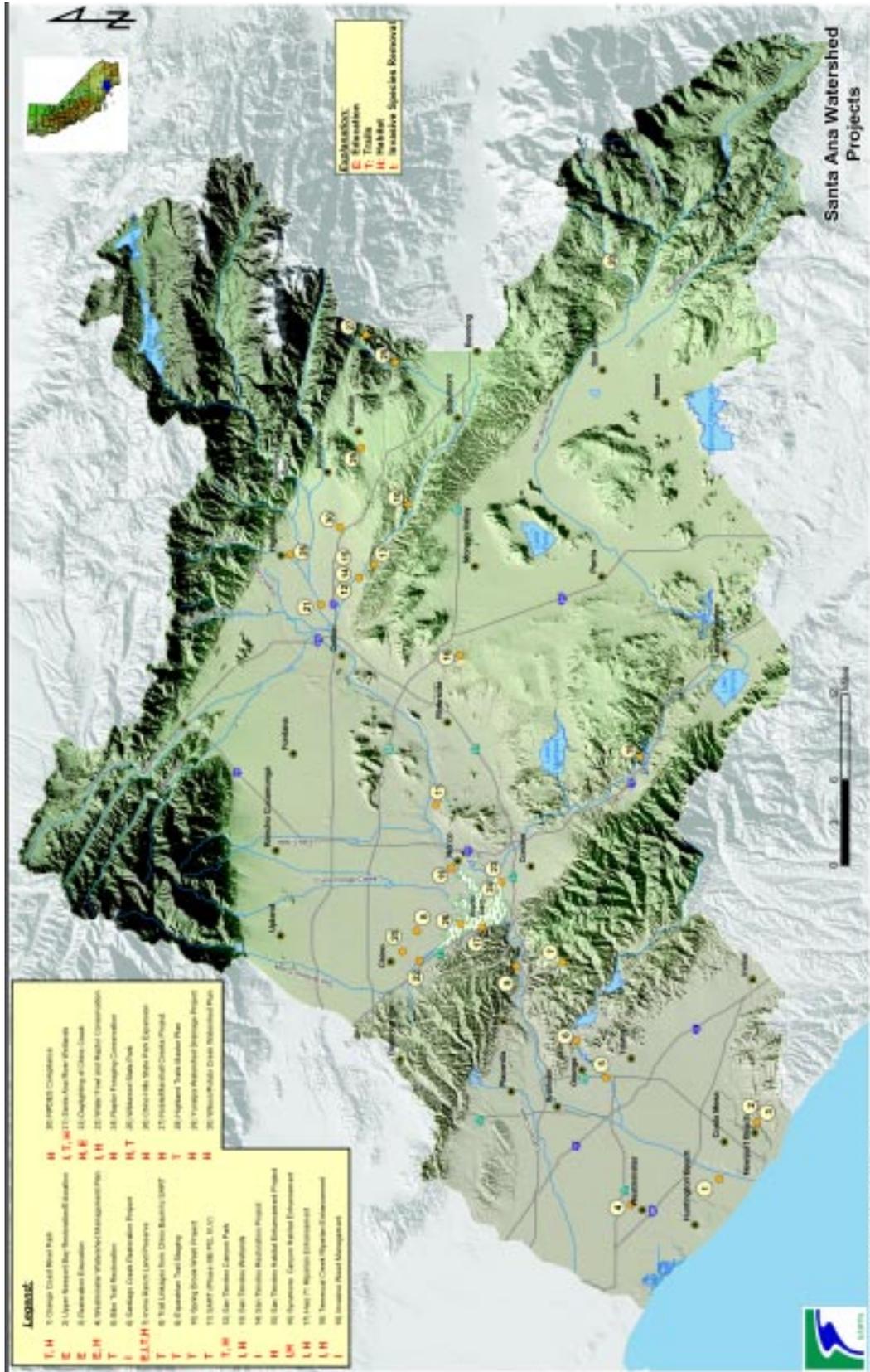


Figure 3-6 Other Projects and Opportunities within the Watershed



Project Name	Agency/ Organization	Contact	Project Cost (in millions of dollars)	Project Description	Ecological purposes met										Project Status			
					ecological functions	improve habitat	water conservation	drought protection	food cover	refuge	sediment	improve water quality	improve stream banks	Other funding sources		Project partners		
SANTA ANA RIVER MOUTH/COASTAL ORANGE COUNTY PROJECTS																		
Orange Coast River Park	Friends of Harbors, Beaches and Parks	Louise Goveley	none provided	1000-1400 acre park at the lower end of the Santa Ana River. WW provides trails, shared support facilities, and a wildlife habitat and park management program.												none provided	concept	
Surflifer Foundation "50th Water Quality Improvement Project"	Surflifer Foundation	Nancy Gardner	2.47	Division of water from Santa Ana River (Greenville-Banning Channel) into a series of sedimentation ponds which will cleanse the water of pollutants before it is released back into the river. Victoria Pond, which provides bird habitat, will be enlarged.												City of Costa Mesa, City of Newport Beach	concept	
Constructed Wetlands-Bolsa Chica Channel	County of Orange- Public Facilities and Resources Department	Mary Anne Skorpanich	1.83	Urban runoff from the Bolsa Chica Channel would be routed through a wetlands system to be constructed on adjacent property at the Seal Beach Naval Weapons Station. The project will consist of a detention system to hold and pretreat flows and a vegetated area that will serve to polish water quality through plant uptake and ultraviolet exposure. A debris boom installed immediately upstream of the project would provide trash removal benefits.												Additional Prop 13 and CWA 319(j) grant programs	City of Huntington Beach, City of Seal Beach, US Navy, Orange County Crosskeeper	feasibility study
Upper Newport Bay Restoration Education	California Coastal Commission	Kristina Finstad	none provided	Involve local schools, community groups, and agencies in restoration and monitoring to enhance wetland, island, and riparian habitat to benefit the LMB ecosystem. This project would build a boardwalk to limit uncontrolled access to sensitive habitat (currently used heavily by walkers, joggers, bikers, and horseback riders)												none provided	none provided	ready to begin implementation
Restoration Education	California Coastal Commission	Kristina Finstad	0.382	Completion of K-12 curriculum specific to Upper Newport Bay with hands-on restoration activities. The community-based restoration program (RCOTIS) will serve the vital purpose of restoring critical species' habitat through the work of community volunteers.												Cal Learn and Serve, Project Learning Tree	CDFC, Orange Co. Harbors, Beaches, and Parks, Newport Bay Naturalist and Friends	ready to begin implementation
Wetland/riparian Management Plan	County of Orange- Public Facilities and Resources Department	Mary Anne Skorpanich	2.50	Develop an integrated, highly collaborative Watershed Management Plan to maintain, restore, and enhance a healthy Watershed/riparian Watershed. Watershed stakeholders will examine existing conditions, identify opportunities and constraints, evaluate alternative projects and management measures, and recommend solutions. The plan would benefit the TMDL process as well as resulting in reduced flooding, protection for sensitive species, enhanced terrestrial and aquatic habitat, and improved quality of life through education, restoration, and aesthetics.												none provided	none provided	concept

Table 3-9 Watershed Projects and Opportunities



Project Name	Agency/ Organization	Contact	Project Cost (in millions of dollars)	Project Description	Ecological purposes met								Other funding sources	Project partners	Project status	
					enhance habitat	improve habitat	water conservation	protect wetlands	food cover	nectar	pollinator	improve water quality				provide other benefits
OTHER ORANGE COUNTY PROJECTS																
Irvine Ranch Water District Natural Treatment System	Irvine Ranch Water District	John Hills	30.00	Alternative for handling dry weather runoff intended to provide new community resources, riparian habitats and water quality benefits throughout the watershed. Low-flow natural and urban runoff, as well as smaller storm flows, will be diverted into non-made wetlands throughout the San Diego Creek Watershed where contaminants will be removed and prevented from reaching the Upper Newport Bay.										Prop 13 state funds and Section 519 state funds, and other public funding resources	County of Orange, Caltrans, City of Irvine	CEQA complete- project ready to implement
Natural Treatment System-East Garden Grove Wintersburg Channel	City of Huntington Beach	Genevieve Lucas	3.47	Diversion of up to 4 MGD of urban runoff into a 20-acre constructed vegetative filter area to remove contaminants. Following treatment, the water would be used to rehabilitate Tolbert Lake and to recharge the groundwater aquifer in the vicinity of Huntington Beach Central Park. Also includes habitat restoration and public education and outreach.										Prop 13 and Wetland Recovery Program	OC-PRRD, Orange County Coastkeeper, City of Seal Beach, and Bolsa Chica Conservancy	in process
Anaheim Recharge Wetlands	none provided	none provided	1.50	This project would install landscaping and other miscellaneous improvements around existing recharge basins. The Feasibility Report is currently being prepared.										none provided	none provided	CEQA in prep
Bike Trail and Restoration	City of Orange	Pamela Geles	none provided	Restoration of concrete-lined right of way and potential bike path implementation on sections of Santiago Creek in the City of Orange.										none provided	none provided	ready to begin implementation
Lower Santiago Creek Restoration Project	Santa Ana Parks, Recreation, and Community Services Agency	Patrick Mitchell	2.00	Community-based restoration: debris removal (e.g., concrete, asphalt, cans), invasive species removal and control, and revegetation with native species for habitat value and bank stabilization.										none provided	none provided	ongoing
Santiago Creek Restoration Project	East Valley Resource Conservation District	David Hansberger/ Jennifer Arns	0.50	Removal of non-native species from tributary to Santa Ana River (Revegetation of sensitive areas along Santiago Creek to prevent erosion following removal of non-native species).										Santa Ana Watershed Association of RCO's	NRCS, OCHD, SANA (Shell Association of Lents)	ongoing
Orange County Public Facilities and Resources Department 1,200-Acre Arundo Removal	Orange County PCRD	none provided	none provided	This project would remove Arundo from the Santa Ana River bottom and restore riparian habitat. The project is located in the Santa Ana River canyon in the Yorba Linda area. The limits are from War Canyon Road to the Orange County line.										none provided	Orange County Water District	planning

Table 3-9 Watershed Projects and Opportunities



Project Name	Agency/ Organization	Contact	Project Cost (in millions of dollars)	Project Description	Ecological Purpose Test								Other Funding sources	Project partners	Project Status	
					restoration/ maintain	improve habitat	water conservation	drought protection	food covers	recreation	education	improve water quality				provide other benefits
Orange County Conservation Corps Azuado Removal at Featherly Park	Orange County Conservation Corps	Mark Stoop	none provided	This project is designed to remove Azuado from a park adjacent to the Santa Ana River and restore riparian habitat. The project is located at Featherly Park in Orange County.										none provided	Orange County Water District	ongoing
Irvine Ranch Land Reserve	Irvine Company	Steve Lettby	not applicable	Land reserve totaling 50,000 acres, including public access and trails. \$30 million commitment from Irvine Company for reserve management, to be carried out by The Nature Conservancy.										Provide funding	TNC, Nature Reserve of Orange County, and others	ongoing
Watershed and Nature Education Center-Santiago Creek	County of Orange-Public Facilities and Resources Department	Chip Monaco	0.55	Expand Santiago Oaks Regional Park's educational facilities to include a watershed and nature education center with high-tech interactive exhibits. The Watershed and Nature Education Center will attempt to achieve three goals: Create an opportunity to change behavior with respect to behaviors affecting water conservation and water quality, provide interactive learning opportunities, expand current educational opportunities to teachers, students, and other groups countywide.										none provided	OCHWD/Blue Planet Foundation, OCSO, MWD of Orange County, Santa Ana Water District, Central Homes/SWICB-6)	concept
Remote Telemetry Irrigation Control (RTIC) Water Conservation System	County of Orange-Public Facilities and Resources Department	Sonia Newer	0.42	Water conservation through installation of evapotranspiration (ET) controllers to reduce over-irrigation. ET controllers adjust water applied to irrigation systems based on temperature, precipitation, wind speed, relative humidity, and solar radiation.										none provided	none provided	Concept
Orange County Water Use Efficiency Best Management Practice	Municipal Water District of Orange County	Joseph M. Bug	35.00	Evaluation of water use, installation of 250,000 ultra low flush toilets and 30,000 irrigation controllers.										OCSO, CAUFED grants, Cal, OCSO, OCHWD, USBR grants, retail water agency contributions	MWD of So. Cal., OCSO, OCHWD	In process
CHINO/PRADO BASIN PROJECTS																
Chino Creek Wetlands	Orange County Water District	John C. Kennedy	1.50	100 acres of constructed wetlands along Chino Creek just above Prado Dam. The wetlands would ensure that drinking water supplies in the Orange County Basin do not exceed the maximum contaminant load of 10 mg/L for TKN and nitrites.										None	US Army Corps of Engineers	CEQA Complete

Table 3-9 Watershed Projects and Opportunities



Project Name	Agency/ Organization	Contact	Project Cost (in millions of dollars)	Project Description	Ecological purposes met								Other funding sources	Project partners	Project Status
					ecological habitat	water conservation	drought protection	food conservation	recycling	reduce water quality	improve water quality	provide other benefits			
Prado River Road Wetlands Expansion	Orange County Water District	John C. Kennedy	3.50	200 acres of constructed wetlands above the River Road Bridge to treat mainstream Santa Ana River flows. The wetlands would ensure that drinking water supplies in the Orange County Basin do not exceed the maximum contaminant load of 10 mg/L for TIN and nitrates.										None	CEQA Complete
Trial Linkages (restorations) from Chino Basin to Santa Ana River Trail	So. Cal. Agricultural Lands Foundation	Chuck Hall	TBD	Critical mass of open space is currently isolated from the mountains to ocean trail master plan. Acquisition and dedication of linkage land is essential for future urban populations.										none provided	concept
Equestrian-friendly trail staging and amenities	Equestrian Coalition of Orange County	Christine McGovern	TBD	Return of Featherly Park to multi-use park including equestrian-friendly trail staging and overnight use. Project also includes construction of equestrian stable at Prado Dam.										none provided	concept
Conservation and Education Programs	Inland Empire Utilities Agency	N/A	N/A	Provide conservation and education programs, including low-flow toilet distribution, high-efficiency clothes washer rebates, Water Education Water Awareness Committee, and Think Earth environmental education programs.										IEUA member agencies	ongoing
Wetlands Restoration	Inland Empire Utilities Agency	N/A	N/A	Collaborative effort with the City of Chino, OCWD, OCFC, ACOE and other watershed partners to restore ecological function and wetlands tributary to the Prado Basin										IEUA member agencies	ongoing
Organics Management Program	Inland Empire Utilities Agency	N/A	N/A	Clean-up, treatment, and reuse of locally generated organics material (fairy manure, bogels, and green material) through development of anaerobic digesters, enclosed composting facilities, advanced sewerage of dairies, and stormwater systems, including restoration of natural treatment systems.										Milk Producers Council, California Energy Commission, USDA Natural Resources Conservation Service, Synagro	ongoing
Regional Plant #5 and #2 Coordinated Habitat and Stormwater Management Plan	Inland Empire Utilities Agency	N/A	N/A	Site plan for IEUA properties within Prado Basin to demonstrate best management practices for stormwater management, organics processing, habitat conservation, and water conservation.										none provided	none provided

Table 3-9 Watershed Projects and Opportunities



Project Name	Agency/ Organization	Contact	Project Cost (in millions of dollars)	Project Description	Ecological purposes met								Other funding sources	Project partners	Project Status	
					enhance habitat	improve habitat	water conservation	drought protection	food cover	erosion	improve water quality	provide other benefits				
REVERSIDGE COUNTY PROJECTS																
River Road Wetlands	none provided	none provided	6.00	This project would construct 300 acres of wetlands to provide natural treatment for Santa Ana River flows prior to using the water in Orange County. The Feasibility Report is complete and the CEQA documents to be prepared in 2002.										none provided	none provided	CEQA Complete
Highway 71 Riparian Enhancement	Riverside-Corona RCD	Shelli Lamb or Kerwin Russell	2.83	Increases open space and improves wetland and upland habitat in the Prado Basin on 100 acres of currently inspected habitat. The project includes removal of 150 acres of eucalyptus, planting of native riparian and upland plants, creation of open space and irrigation of installed plant material and monitoring of listed species.										none at this time	OCWD, US ACE, US FWS	planning
Dairy Waste Water Project	Inland Empire West RCD	Paul Hogan	TBD	Assist local dairies in the development of plans and specifications for the construction of waste water containment and settling ponds. Provide funding for construction.										none provided	none provided	planning
NPDES Compliance	Inland Empire West RCD	Paul Hogan	TBD	Technical and financial assistance to offset working toward compliance with NPDES goals. This project will become crucial to citizen ability to access needed funds to upgrade or retrofit catch basins and perform other related work.										none provided	none provided	concept
Mockingbird Canyon Floodplain Acquisition	Western Municipal Water District		none provided	This project would prevent (via purchase) encroachment of development into a riparian area upstream of the city of Riverside. The area could conceivably be used as a source of environmental mitigation banking, as well as being a site for potential stream restoration and wildlife corridor enhancement.										none provided	none provided	planning
Tamascal Creek Riparian Enhancement	Riverside-Corona RCD	Shelli Lamb or Kerwin Russell	1.25	Targets 50 acres of riparian habitat restoration and small ponds for nutrient polishing, fresh water marsh and effluent water use for wetland creation, with installation of native plants and wetland vegetation.										none at this time	SM Corporation, CDFG, City of Corona	ongoing planning
Lake Elanore Nutrient Removal (Wetlands)	Lake Elanore/San Jacinto Watersheds Authority (LESJWA)	Mark Norton	12.00	Project includes purchasing land, constructing a back basin wetlands, and implementing other nutrient control measures for Lake Elanore in order to provide a natural method to reduce the lake's high nutrient level and provide an improved wildlife habitat. The existing 365-acre wetlands in the back basin could be reconfigured to provide advanced treatment to recycled water added to the lake and circulate lake water.										none provided	none provided	planning

Table 3-9 Watershed Projects and Opportunities



Project Name	Agency/ Organization	Contact	Project Cost (in millions of dollars)	Project Description	Ecological purposes met								Other funding sources	Project partners	Project status	
					enhance habitat	improve habitat	water conservation	drought protection	food covers	recreation	education	improve water quality				provide other benefits
Nutrient Removal Elkstone Valley Municipal Water District Regional Reclamation Treatment Facilities	Lake Eairons/San Jacinto Watersheds Authority (LESJWA)	Mark Norton	0.6	This project would increase nitrogen and phosphorus removal capacities at EMWD's Water Reclamation Plants to obtain water quality objectives and nutrient levels sufficient to discharge into Lake Eairons to improve water quality and stabilize lake levels.										none provided	Eastern Municipal Water District	planning
Nutrient Removal Eastern Municipal Water District Water Reclamation Plants	Lake Eairons/San Jacinto Watersheds Authority (LESJWA)	Mark Norton	10	This project would increase nitrogen and phosphorus removal capacities at EMWD's Water Reclamation Plants to obtain water quality objectives and nutrient levels sufficient to discharge into Lake Eairons to improve water quality and stabilize lake levels.										none provided	Eastern Municipal Water District	planning
Non-native plant material removal	Lake Eairons/San Jacinto Watersheds Authority (LESJWA)	Mark Norton	2.4	This LESJWA project would remove non-native plant materials in the back basin of Lake Eairons that are taking over the natural habitat. This project would enhance and protect the wildlife habitat.										none provided	Western Municipal Water District	none provided
Installation of Aeration System/ Hypolimnetic Oxygenation System	City of Canyon Lake/ County of Riverside	Dell Powers	0.50	Structural water quality improvement: Installation of an aeration system to improve drinking water of Canyon Lake and water quality for recreational uses.										LESJWA, City of Canyon Lake, EVMWD	Eairons Valley Municipal Water District	planning
Riverside County Arundo Removal	Western Municipal Water District	none provided	none provided	This program would remove a large part of the Arundo in the middle portion of the riverbanks that are held or controlled by WWMWD. This program has been operating using mitigation funds and is in need of expansion to meet further removal goals.										none provided	none provided	ongoing
Santa Ana River Bikeway/Trail- Phase III-Part 2, Phase IV, Phase V (Riverside Co.)	County of Riverside (1) Reg. Park & Open Space District (2) Transportation Department	(1) Mark Brewer (2) Sierra B. Alvarado	1.50	Implementation of approved alignment for the Santa Ana River Trail in Riverside County. Phase III-2 involves installation of a bridge across Hole Lake to complete a missing link to the Santa Ana River Trail. Phase IV extends the Trail for an additional 2 miles westerly from Tyler Street.										none provided	none provided	CEQA complete

Table 3-9 Watershed Projects and Opportunities



Project Name	Agency/ Organization	Contact	Project Cost (in millions of dollars)	Project Description	Ecological purposes met								Other funding sources	Project partners	Project status		
					enhance riparian ecological function	improve habitat	water conservation	drainage protection	food control	recreation	education	improve water quality				improve other benefits	
Sycamore Canyon Habitat Enhancement	Riverside-Contra RCD	Shell Lamb or Kevin Russell	0.3	Project encompasses 22 acres of riparian habitat in 1,500-acre Sycamore Canyon Wilderness Area. Approximately 5 acres of riparian habitat will be restored in conjunction with completed arundo removal and supplemental water during the dry season for 5 years.											currently none	City of Riverside Parks Department, WAWCD, CDFG	planning
Vail Canyon Non-native Vegetation Removal Project	Rancho California Water District	Andrew Weibler	0.30	Three year program consisting of non-native invasive vegetation removal and trash removal within Vail Canyon. Project will remove potential for groundwater contamination caused by abandoned cars and appliances and invasive species removal will increase the availability of local water.											NCWD General Fund	none provided	none provided
Santa Ana River Restoration Project	Riverside County Regional Park and Open Space District	Ron Bauer	40.00	Arundo removal and restoration of river bottom by native species (willow, cottonwood, sycamores, mullet, etc.). Project will improve ecological function by restoring native wildlife habitat and increasing available water.											none provided	none provided	ongoing
Spring Brook Wash Project	Endangered Habitats League	Jane Block	0.03	Assess conservation needs of multi-use corridor extending from the closed county landfill at Pigeon Pass to Fairmont Park, and determine the most biologically feasible connection for wildlife and trail users from the Box Springs Mountains to the Santa Ana River and the Coast-to-Mountains trail system.											Private residential developer	To be submitted	planning
San Timoteo Canyon State Park	Riverside Land Conservancy	Pete Dangelmond	40.00	Creation of a new State park centered around San Timoteo Creek Watershed that will increase water quality in San Timoteo Canyon and subsequently the Bunker Hill Basins. The park will provide a number of linkages with other habitat areas in the county, as well as reestablishing, creating, restoring, and protecting wetlands in the floodplains of the canyon and its major tributaries from Loma Linda to I-10.											US EPA, WCB, Cal. State Parks, US ACE, County Habitat Funds	State Parks, Wildlife Conservation Board, City of Loma Linda	planning
San Timoteo Creek Watershed Restoration and Wetlands Creation Project	Riverside Land Conservancy	Annie Monrabe and Peter Dangelmond	11.00	Invasive species removal, land acquisition, restoration											Federal Grant and Prop 12	EPA, City of Redlands	ongoing
San Timoteo Restoration Project	East Valley Resource Conservation District (for Aris)	David Hensberger/Aris	0.50	Removal of invasive weeds beyond Arundo domes, including castor bean, perennial poppenweed, German Ivy, and tree of heaven.											Santa Ana Watershed Association of RCD's	NRCS, OCWD, SANWA (Shell Association of Loma)	ongoing

Table 3-9 Watershed Projects and Opportunities



Project Name	Agency/ Organization	Contact	Project Cost (in millions of dollars)	Project Description	Ecological purposes met								Other funding sources	Project partners	Project status	
					ecological benefits	improve habitat	water conservation	protect wetlands	food cover	recreation	education	improve water quality				provide other benefits
San Timoteo Habitat Enhancement Project	East Valley Resource Conservation District/Jennifer Area	David Harabergel/Jennifer Area	0.05	Restoration of tributary to natural state by removing trash debris within the creek bed. The project will involve coordination with appropriate agencies to conduct a series of clean-up dates. For public outreach, local volunteer agencies and residents will be encouraged to participate in clean-up dates.										Santa Ana Watershed Association of Landb RCCD's	NRCDS, OCWD, SAWWA (Shell Landb)	ongoing
Hornet San Jacinto Wildlife Area Environmental Enhancement and Recycled Water Storage Initiative	Eastern Municipal Water District	Mike Garner	N/A	Environmental enhancement, use of recycled water for restoration of historic wetlands, recycled water conservation, groundwater management, agricultural water supply, and maintenance of compatible uses around the SJWA.										CDFG	CDFG	ongoing
San Jacinto Flow through Wetlands	LESJWA	Mark Norton	3.00	This LESJWA project would create a flow-through wetlands that would provide both habitat enhancement and nutrient removal to the San Jacinto River from Canyon Lake to Lakeshore Drive. The project would provide recreational opportunities through the creation of trails for biking, walking, or viewing habitat.										none provided	none provided	planning
San Jacinto River Stage 4 Project	Riverside County Flood Control and Water Conservation District	Zully Smith	none provided	Project is designed to increase the width of the San Jacinto River downstream of the existing Corps levees from about 500 feet to 1200 feet, creating additional habitat value, flood control, and water quality improvement.										none provided	none provided	planning
Invasive Wood Management Program	Inland Empire West RICD	Raul Hogan	TBD	Removal of invasive weeds, including but not limited to: Arundo donax, Lemnack sp., cancer bean, and others.										Prop 13 and Prop 14 grants	RC RCCD, EVRCCD, OCWD	ongoing
Sustainable Agricultural Lands Demonstration Project	So. Cal. Agricultural Lands Foundation	Chuck Hale	TBD	Possible joint venture within IEJA Master Plan area. Environmentally sensitive agricultural heritage education demonstration.										none provided	none provided	concept
20-Year Land Use Open Space Plan	So. Cal. Agricultural Lands Foundation	Chuck Hale	TBD	Development of a strategic land plan for 20 years into the future: acquisitions, exchanges, consolidations, trail acquisitions. Agricultural sustainable use including practices that are environmentally sensitive to watershed.										none provided	none provided	concept

Table 3-9 Watershed Projects and Opportunities



Project Name	Agency/ Organization	Contact	Project Cost (in millions of dollars)	Project Description	Ecological purposes met							Other funding sources	Project partners	Project status		
					enhance habitat	improve habitat	water conservation	trash protection	bird control	invasives	improve water quality				provide other benefits	
Landscape/ Agriculture Waste Management Evaluations	Riverside Corona RCD/ WMWD	Shel Lamb or Kevin Russell	0.22	Maximum of 15 water management evaluations on large water use sites. Evaluations would recommend design, management, and cultural practices to improve water conservation.									none provided	Bureau of Reclamation, Department of Water Resources, Orange County Water District	concept	
SAN BERNARDINO COUNTY PROJECTS																
Chino Creek Park	Inland Empire Utilities Agency	Richard Ableser or Eliza Jane Whisman	TBD	Elimination of box culvert and restoration of natural stream and flood plain. Also creates upland areas to an educational park.										none provided	none provided	concept
Chino Hills State Park Expansion	California State Parks	Geary Hund	none provided	Expansion of existing state park to provide habitat linkages to the Santa Ana River and Prado Basin. Landform restoration (soil sloping and recontouring, revegetation), construction of bridges over Aliso Creek										none provided	none provided	planning
Wetlands and Habitat Conservation Area	City of Ontario	Jerry Blum	24.20	Wetlands construction and habitat acquisition. Plans include conjunctive uses such as a perimeter nature trail and walkway, interpretive learning center, observation areas for bird watching, and wetland nesting areas. Includes 85 acres of restoration and 145 acres of land acquisition.										City of Ontario, US ACE, US Army Corps of Engineers	US ACE, USFWS, CDFG, San Bernardino Transportation and Flood Control District	CEDA complete
Raptor foraging conservation area	City of Chino	Bob Preese	N/A	Mitigation for Chino Sphere of Influence annexation (5,400 acre conversion from agricultural land to urban land). Will provide 300 acre foraging area for raptors. The city is looking to pair this project with other conservation efforts.										none provided	none provided	planning
Cucamonga Creek Wetlands	Inland Empire Utilities Agency	Eliza Jane Whisman	5.00	This project would construct wetlands to provide natural treatment for Cucamonga Creek, located in IEUA.										none provided	none provided	planning
Santa Ana River Wetlands (Mission Zanja Creek Channel)	S.B. Co. Dept. of Public Works, Regional Trails Division	Jeff Whisman	0.8	Creation of a wetlands on the Santa Ana River at the confluence of the Mission Zanja Creek Channel in the City of San Bernardino. The project will entail the removal of non-native vegetation and the planting of native species. Interpretive signage, boardwalk, and bike path will provide access and educational opportunities for the users.										Wetlands Conservancy, State Parks, Prop 40	Wetlands Conservancy, San Bernardino County Flood Control District	planning

Table 3-9 Watershed Projects and Opportunities



Project Name	Agency/ Organization	Contact	Project Cost (in millions of dollars)	Project Description	Ecological purposes met								Other funding sources	Project partners	Project status
					enhance habitat	improve habitat	water conservation	through protection	food cover	recreation	education	improve water quality			
Mill Creek Splotter 5 Wetlands	Orange County Water District	John C. Kennedy	0.50	Diversion of Mill Creek flows through the US Army Corps of Engineers Splotter 5 Wetlands System. The wetlands would naturally remove nitrates from surface water supplies flowing into the Prado Dam basin and would ensure that drinking water supplies in the Orange County Basin do not exceed the MCL of 10 mg/L for TN and nitrate.									none provided	US Army Corps of Engineers	CEEA complete
City of Highland Trails Master Plan Implementation	City of Highland	Bruce Meikle	none provided	Major goal: ensure trail connections with the Santa Ana River Trail. Proposed trails follow existing driveways/ance roads owned or controlled by public agencies or utilities.									none provided	none provided	planning
San Timoteo Wetlands	none provided	none provided	6.00	This project is designed to increase water quality and quantity in San Timoteo Canyon, and subsequently the Barker Hill Basins, through the re-establishment, creation, restoration and protection of wetlands in the floodplains of the canyon and its major tributaries from Loma Linda to Interstate 10.									none provided	none provided	none provided
Yuccapa Valley Water District Wetlands Enhancement	Yuccapa Valley Water District	Joe Zoba	5.00	This project would construct a 30 acre wetlands facility to polish recycled water prior to discharge to San Timoteo Creek. The project includes pipelines, hydraulic control structures, control systems, and a new 30 acre wetlands. Discharge from the new wetlands would support the existing riparian habitat downstream of the existing YVWD point of discharge to San Timoteo Creek.									none provided	none provided	planning
Wildwood State Park	Yuccapa Valley Conservancy	Frank Saacra	none provided	Proposed park is headwaters for Live Oak Canyon and Noble Creeks, which flow to San Timoteo Creek and Santa Ana River. The area also serves as a wildlife corridor from the San									none provided	none provided	planning
Yuccapa Watershed Drainage Project	East Valley Resource Conservation District	David Hansberger	6.00	Construction of 3 detention basins for flood protection and erosion prevention (2 at the confluence of Wilson and Oak Glen Creeks and one basin in Wildwood Creek).									none provided	City of Yuccapa, Yuccapa Valley Water District	planning
Wilson and Probito Creek Watershed Plan	City of Yuccapa	Jennifer Shankland	4.00	Construct a series of spillover detention basins to provide flood control, groundwater recharge and habitat preservation as part of the Wilson Creek and Probito Creek Watershed Management Program. Natural improvements will be made to Wilson Creek in lieu of PCC lined channels.									EPA	San Bernardino County, Yuccapa Valley Water District, Yuccapa Calimesa Joint Unified School District	planning

Table 3-9 Watershed Projects and Opportunities



Project Name	Agency/ Organization	Contact	Project Cost (in millions of dollars)	Project Description	Ecological purposes met								Other funding sources	Project partners	Project status
					wetland function	improve habitat	water conservation	drought protection	food cover	recreation	water quality	provide other benefits			
Noble Creek/Mansell Creek Wetland Project	Beaumont-Cherry Valley Water District	Chuck Buzhar	25.7 (total for overall larger project)	Project comes from Recycled Water Master Plan. The District has a stormwater recharge program currently under design which plans for the utilization of recycled water in constructed wetlands (for additional nutrient removal) and subsequent groundwater recharge to the Beaumont Storage Unit.									local funding and private funding	City of Beaumont	planning
San Jacinto Habitat Acquisition	Eastern Municipal Water District	none provided	none provided	This project would acquire mitigation property identified in a Habitat Conservation Plan, allowing EMWD to proceed with a major conjunctive use project featuring all of the major environmental objectives established in the Califed program.									none provided	Eastern Municipal Water District	planning
Rancho California Water District Arundo Removal	Rancho California Water District	none provided	none provided	This project would remove Arundo from the Rancho California Water District service area, primarily within the Murrieta Creek area. The removal of invasive species would enhance the groundwater recharge capabilities of the creek and thereby allow greater recharge of the groundwater basin.									none provided	Eastern Municipal Water District	planning
San Jacinto State Park	California State Parks	Geary Hund	N/A	New State Park, consisting of 13,000 acres. The park is home to endangered species, and is meant to combat habitat fragmentation issues.									none provided	none provided	complete
WATERSHED-WIDE PROJECTS															
Native and Treatment Wetlands	none provided	none provided	56.50	This five-year program will develop and fund projects in Orange, Riverside, and San Bernardino counties in areas where improvements to water quality are the most critical. The creation and restoration of wetlands in the watershed is essential to improving water quality and reducing the impacts of non-point source pollution. Wetlands are used for natural water treatment and serve as a buffer to the river and its tributaries. They also provide environmental habitat and a cleaner more resilient system for surface waters. Treatment wetlands are constructed where larger flows of highly estroptic waters are found to reduce nutrients and other pollutants and provide habitat. These areas may be surrounded by natural wetlands and provide habitat for many sensitive, endangered, and threatened species. Natural wetland restoration will also be provided in areas where land and function can be maintained.									Prop 40, Prop 50, Prop 13	USFWS, USACE, CDFG, RWQCCB	program adoption

Table 3-9 Watershed Projects and Opportunities



Project Name	Agency/ Organization	Contact	Project Cost (in millions of dollars)	Project Description	Ecological purposes met							Other funding sources	Project partners	Project Status	
					enhanced habitat	improved hydrological functions	improve habitat	water conservation	drought protection	bird cover	restoration				education
Santa Ana River Trail Pathway	none provided	none provided	\$2.00	This project would further develop the Santa Ana River Trail and Pathway along the Santa Ana River. The trail is completed in Orange County and parts of Riverside and San Bernardino Counties. More improvements, however, are needed to complete and upgrade the multiple trail to connect the San Bernardino Mountains and the Pacific Crest Trail. This trail would connect important areas in the inland empire cities and counties, thus expanding regional access and availability to existing parks and riverfront areas, as well as providing alternative transportation and recreation opportunities.									Prop 40	Orange County, Riverside County, San Bernardino County, cities within watershed, and other groups	ongoing
East Valley Resource Conservation District Arundo Removal	East Valley Resource Conservation District	David Hurlberger	none provided	Projects currently in process of first-time treatment would continue on all upper watershed tributaries, as well as maintain Santa Ana River down to Riverside County Parks and Open Space District lands (and on to Orange County). The program would also provide education to private landowners through written materials, workshops, and hands-on assistance. Database maintenance would include areas of infestation, current projects, sensitive species, and native vegetation recovery.									none provided	San Bernardino Valley Municipal Water District	ongoing
Arundo Removal/SAWA Restoration	SAWA	Shelli Lamb/ Kevin Russell	\$6.00	This five to ten-year project seeks to remove the Arundo donax (joint cane) from the Santa Ana Watershed and restore some 10,000 acres of riparian habitat. Funding to date has provided almost \$25,000,000 and will take at least five years to complete; however, more funding is needed for agencies to more aggressively remove the species and monitor removal for five or more years.									Proposition 53, local mitigation, etc.	SAWA, Riverside Co. Parks, RCFCD, OC COWD, OC PHRD, Monarchs, OCCC, CCC	ongoing
Santa Ana Sucker Conservation	Santa Ana Sucker Discussion Group	none provided	TBD	Increases in variability of stream edges and bottom topography. Re-establishment of meanders, vertical banks, pools, and riffles. Placement of coarse materials (stone and gravel) in the river.									Local funding	Riverside, San Bernardino, OCPRD, OOSD, OCOWD, RCFCD, SBFCFD	ongoing
Annual Inland Coastal Watershed Cleanup	Trails 4 All	Jim Meyer	N/A	Annual inland waterway cleanup in conjunction with international coastal cleanup day. The intention is to remove trash and debris from inland waterways before it has a chance to reach the coast. Over 2,000 volunteers in 2001. In 2002, over 34,000 pounds of debris were collected.									The Irvine Company, Y&R Industries, Boeing, & more	The Irvine Company, Y&R Industries, Boeing, & more	ongoing annual event

Table 3-9 Watershed Projects and Opportunities



Watershed Structure and Function Restoration Recommendations

The restoration recommendations are intended to allow jurisdictions, communities, and groups to advance, promote, and enable the concepts below.

Recommendation #1: Improve Water Quality and Preserve and Improve Ecosystem Function

- 1-A. Develop water treatment wetlands and channels to improve water quality in a sustainable manner and provide multiple benefits.
- 1-B. Protect, restore and widen riparian vegetation corridors to reduce impacts of stormwater runoff, provide habitat, and improve aesthetics.
 - Reintroduce vegetated buffer strips wherever possible along stream banks to reduce the force of a flooding current against the bank, slow water overflowing channel banks, and allow sediment to deposit.
 - Ensure that riparian vegetated buffer strips are as wide as possible, although a narrow strip is better than none at all.
- 1-C. Carefully plan human activities to reduce erosion.
- 1-D. Continue to utilize technologically advanced sustainable solutions to resource management dilemmas, such as water quality improvements.
- 1-E. Reduce or eliminate beach closures through water quality improvements and reduction of contaminant discharge into the Pacific Ocean.

Recommendation #2: Protect and Restore Habitat Resources

- 2-A. Restore natural wetland habitats in flood plains of the River and its tributaries.
 - Look for opportunities in natural undeveloped areas to add wetlands that will increase complex natural habitats in juxtaposition to the stream system.
 - Connect wetlands to the stream corridor through the addition of channels and vegetation.
- 2-B. Protect and restore remaining native species and habitats.
 - Recreate meanders and backwaters where possible within the River and its tributaries to enhance native fish habitat.
 - Create drop structures and other oxygenation devices that do not inhibit fish passage.
 - Reestablish riffle substrates.
 - Develop instream structures to promote pool and flow complexes.
- 2-C. Identify public and private agencies and organizations to maintain acquired lands and funding sources.
- 2-D. Acquire key parcels of land for conservation.
 - Establish conservation goals and target selection criteria.
 - Identify key potential parcels based on selection criteria.
 - Negotiate conservation easements as an alternative to outright purchase of lands.



- 2-E. Promote the identification, establishment, and protection of wildlife corridors.
- 2-F. Connect upland vegetation and habitats through edge habitats and corridors.
 - Locate isolated habitat patches and establish corridors suitable to increase the habitat diversity available to all species.
 - Plant native trees, shrubs, and forbs to establish wildlife-friendly pathways along roads and channels.
- 2-G. Remove and control exotic species.
 - Continue active programs for removal of established invasive species.
 - Identify and control recently established invasive species to prevent further spread.
 - Prevent introduction of future invasive species.

Recommendation #3: Engage the Community through Education and Recreation

- 3-A. Improve recreational opportunities for the region, including access to streams, lakes, and beaches through dedication of easements and land acquisition.
- 3-B. Increase water conservation and decrease imported water use through public education and provision of water saving devices.
- 3-C. Involve the public through outreach and education coordinated with the agencies and schools in the watershed.
- 3-D. Increase available open space throughout the region, including balancing open space availability among various communities by increasing parkland acreage in densely urbanized areas.

Recommendation #4: Plan for the Future

- 4-A. Facilitate partnerships among groups with similar goals and support community based sub-watershed groups.
- 4-B. Work with the State Resources Agency through the California Watershed Management Forums and other standard Regional Agencies to achieve State and regional goals.
- 4-C. Use the best scientific data available and regional collaboration to make complex resource management decisions.
- 4-D. Promote effective watershed monitoring, data management, and project evaluation programs.
- 4-E. Identify and pursue future sources of funding to complete watershed projects. Funding source identification should include provisions for operation and maintenance of projects in addition to capital expenditures.
- 4-F. Utilize this Santa Ana Integrated Watershed Plan, Environmental and Wetlands Component as a living document, including regular updates to maintain current watershed-wide planning and coordination.

C. Next Steps

Plan Life Continues Beyond Today

In as much as this Plan presents a snapshot of the innovative projects and summarizes the plans and projects of many agencies, it will quickly age. SAWPA has received excellent feedback from agencies, groups, and individuals in this process.



The dynamic nature of projects and plans in the Watershed necessitates their update and renewal on a relatively frequent basis. This Plan will be used by agencies in the Watershed to help integrate plans and to focus funding on projects that are most effective and ready to proceed. This information must remain current to be effective.

Additionally, revisions to this Plan's strategies aimed at restoring the ecological function of the Watershed will develop over time forming a culture for the Watershed community. Future revisions of this document will capture these developments, new projects that are created, and projects currently listed that develop and evolve.

The SAWPA Commission will adopt this plan as part of the Integrated Watershed Plan for the Santa Ana River Watershed and will use it to guide funding and development priorities.

As the need for update and the funding is available, SAWPA will initiate efforts to update and refine this Plan. Necessary elements for inclusion in Phase II of the Environmental and Wetlands Component are as follows:

- More information on the natural history of the watershed, including vegetation descriptions.
- An assesment of remaining significant habitat is needed. This assessment is essential for setting priorities. A more detailed description of natural resources, including vegetation, and a more comprehensive analysis of the ecological function of the Santa Ana River is needed.
- An expanded, more comprehensive assessment of ecological/open space/recreational resources and their significance to the region, the state, and the nation would be useful in seeking further funding.

- Further information to explain what is special about the Santa Ana Watershed as a system, and what it contributes to California's and the nation's resources overall.
- Development of a multi-benefit, multi-agency strategy to help achieve agreed-upon watershed goals.
- Gap analysis for the watershed.
- Development of a coordinated, multi-benefits, multi-agency strategy to help achieve agreed upon watershed goals.

Given that everyone associated with the Santa Ana Watershed is inextricably linked from the mountains to the Pacific Ocean, additional partnering with State, federal, and regional agencies to further watershed planning efforts is vital. The actions of upstream users impact the quality of life of downstream users, and keeping this connection in mind is very important to improving both the overall ecological function of the watershed and the quality of life of its residents.



Prado Wetlands
Photo courtesy of SAWPA



Finally, further efforts to engage the planning community (i.e., community development and planning staff at Watershed cities and other agencies at every level of government as well as private sector planning) should include training, workshops, and other educational forums to facilitate free exchange of innovative ideas and information related to the implementation of watershed planning. Realization of the recommendations and projects in this document and future iterations of this document require planning staff engagement and dedication. The Santa Ana Watershed is making progress toward a healthier and more ecologically sustainable watershed through continued collaboration and leadership in the protection of its resources.